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FIG. 1—Eupatorium thicket amid scattered deciduous trees on a ridge "bald" traversed by a cattle-path, at east end of Roan Mountain, North Carolina.



FIG. 2—"Laurel bald" on the slope of Grandfather Mountain, North Carolina, forming the thicket habitat of *Podisma glacialis variegata* and *Melanoplus sylvestris*. Berry-pickers camped beside the Yonahlossee road.

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RESEARCHES

ON

NORTH AMERICAN ACRIDIIDÆ

BY

ALBERT PITTS MORSE

Research Assistant, Carnegie Institution of Washington



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RESEARCHES ON NORTH AMERICAN ACRIDIIDÆ

By ALBERT P. MORSE,
Research Assistant, Carnegie Institution of Washington.

INTRODUCTION.

The work on which report is here made was done under a grant from the Carnegie Institution of Washington and was directed toward the acquisition of facts of faunal, biological, and morphological value concerning the Acridian fauna of the southeastern United States, a portion of the country hitherto largely unexplored with reference to this group of insects.

A study of the general topography, based, when possible, on the maps of the United States Geological Survey, led to a plan of operations in accordance with variations in the life history of different species. This plan involved an examination of the different life zones of the region at as early and as late dates as practicable, in order to secure earlier and later maturing forms, since it is impossible, with our present knowledge, to distinguish many of the species with certainty save in the adult state.

About 60 widely separated localities were examined in 68 days during a trip of 3,000 miles through the region under inspection. Approximately 6,000 specimens were secured in this time, representing 90 species of Acridiidæ (of which one-sixth were new to science), together with notes of great biological interest.

Many important data relating to the biology and distribution of the group were secured; but in some cases, owing to the character of the trip—a rapid reconnaissance over a wide extent of territory for the purpose of securing general information—the results should be regarded as tentative until further detailed studies can be made.

This report includes a general account of the investigation and a statement of the results secured; the data on which the generalized statements are based, in the form of an annotated list of the species taken, with locality, habitat, and date of capture; brief notes on the geographical and zonal distribution of the genera of North American Acridiidæ; and contributions to locust biology in

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the shape of a classification of locust habitats and societies and an explanation of brachypterism in Orthoptera.

Acknowledgments are due, primarily, to the Carnegie Institution for the means wherewith to pursue this investigation; secondly, to Mr. Samuel Henshaw, of the Museum of Comparative Zoology, for the opportunity to study critically the Scudder collection, without access to which certainty of determination would in many cases have been impossible; and finally, to numerous fellow-scientists, travelers, and observers, for their cordial interest and assistance in various ways. Among these I desire epecially to mention Mr. J. H. Emerton, of Boston; Messrs. Sherman and Brimley Bros., of Raleigh, and Boynton, of Biltmore, North Carolina, for information regarding conditions and localities; and Messrs. Fernald and Greenman, of Cambridge, Massachusetts, for determination of plant specimens.

BIOLOGICAL IMPORTANCE OF THE SOUTHEASTERN UNITED STATES.

The chief biological importance of the Southeastern United States, comprising Virginia, North and South Carolina, Georgia, Florida, Alabama, eastern Tennessee, and West Virginia, is connected with two facts: First, this region served during the Glacial Epoch as a refuge for boreal forms of life which had been pushed southward by the climatal conditions of the Ice Age, and at the close of that period it became the center of dispersal whence these forms were able to restock the opening country at the north. Second, during this later period its lowland plains served, and probably continue to serve, as a highway of dispersal for austral forms entering the country from the south and southwest, many of which have penetrated far into the heavily glaciated region of the Northern States.

Notwithstanding its great biological importance, this region has not received the attention scientifically which it deserves, save with reference to certain groups and in certain sections, such, for instance, as peninsular Florida, which, owing to its southern position and consequent attractiveness, both biologically and as a winter resort, has received considerable attention and study. As a matter of fact, the Acridian fauna of no area in the United States of equal size and biological importance was so little known at the beginning of the year. For this reason it was decided to spend the summer in a general reconaissance trip through the region, securing as many facts relative to systematic facies, geographical, zonal, and seasonal distribution, habitats and environmental conditions, life histories, etc., as possible.

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LOCALITIES AT WHICH COLLECTING WAS DONE.

A list of the points at which collecting was done, with their elevation, if known, especially in the mountainous regions, and the dates of visit, is subjoined.

Virginia:

Appomattox, Appomattox Co., Sept. 6; 800 feet.
Cape Henry, Princess Anne Co., July 2, 4, Sept. 7.
Hickory, Norfolk Co., July 3.
Norfolk, Norfolk Co., Sept. 8.
Roanoke, Roanoke Co., Sept. 6; 1000 to 1600 feet.
Virginia Beach, Princess Anne Co., July 2, 4, Sept. 7.
Wytheville, Wythe Co., Sept. 4, 5; 2200 to 3500 feet.

North Carolina:

Asheville, Buncombe Co., July 21, 22; 2000 to 3000 feet.
Balsam, Jackson Co., July 23, 24; Aug. 19, 20; 3000 to 6200 feet.
Blowing Rock, Watauga Co., July 19; 3800 feet.
Cranberry, Mitchell Co., July 14, Aug. 28; 3200 feet.
Eure, Gates Co., July 5, 6.
Governor Island, Swain Co., Aug. 20; 1800 feet.
Grandfather Mt., Mitchell and Caldwell Cos., Aug. 29; 4800 to 5500 feet.
Greensboro, Guilford Co., July 10.
Lenoir, Caldwell Co., July 19; about 1500 feet.
Linville, Mitchell Co., July 17, 18; Aug. 30; 3800 feet.
Loverings, Burke Co. (between Morganton and Pineola), July 13; 3500 feet.
Morganton, Burke Co., July 12, 20; 1200 feet.
Murphy, Cherokee Co., July 25, Aug. 22; 1600 to 1800 feet.
Pineola, Mitchell Co., July 13, 14, Aug. 28; 3800 feet.
Raleigh, Wake Co., July 8, 9.
Roan Mt., Mitchell Co. (and Carter Co., Tenn.), July 15, 16, Aug. 31, Sept. 1, 2; 4000 to 6300 feet.
Roan Valley, Mitchell Co., July 16, Sept. 1; 4000 feet.
Salisbury, Rowan Co., July 11.
Saluda, Polk Co., Aug. 17; 2200 to 2400 feet.
Selma, Johnston Co., July 7.
Tarboro, Edgecombe Co., July 6, 7.
Topton, Cherokee Co., Aug. 21; 2700 to 4400 feet.
Tunis, Hertford Co., July 5.

South Carolina:

Columbia, Richland Co., Aug. 16.
Denmark, Bamberg Co., Aug. 14, 15.
Spartanburg, Spartanburg Co., Aug. 16, 17.

Georgia:

Blue Ridge, Fannin Co., July 25; 1700 feet.
Bolton, Cobb Co., July 29; 800 feet.
Jasper, Pickens Co., July 25, 26; 1500 to 2600 feet.
Marietta, Cobb Co., July 27; 1000 to 1200 feet.
Sand Mountain, Dade Co. (near Trenton), Aug. 25; 1500 feet.
Savannah, Chatham Co., Aug. 13, 14.
Stone Mountain, DeKalb Co., July 28; 1000 to 1685 feet.
Trenton, Dade Co., Aug. 25; 500 feet.
Tybee Island, Chatham Co., Aug. 12, 13.
Waycross, Ware Co., Aug. 11.
West Point, Troup Co., July 30.

Florida:

Carrabelle, Franklin Co., Aug. 9.
De Funiak Springs, Walton Co., Aug. 5.
Fort Barrancas, Escambia Co., Aug. 3.
Live Oak, Suwanee Co., Aug. 10.
Marianna, Jackson Co., Aug. 6, 7.
Tallahassee, Leon Co., Aug. 8.
Warrington, Escambia Co., Aug. 4.

Alabama:

Flomaton, Escambia Co., Aug. 1, 2.
Greenville, Butler Co., July 31.

Tennessee:

Burbank, Carter Co., July 17, 3000 to 3300 feet.
Chattanooga, Hamilton Co., Aug. 24; 700 to 800 feet.
Johnson City, Washington Co., Aug. 27; 1700 feet.
Lookout Mountain, Hamilton Co., Aug. 23; 2000 feet.
Morristown, Hamblen Co., Aug. 27; 1400 feet.
Roan Mountain Station, Carter Co., July 17, Sept. 3; 2600 feet.

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While making special efforts to secure Acridiidæ, the other species of Orthoptera coming to hand were also taken, broadening somewhat the scope of the inquiry, without interfering with its main object. A folding camera was carried and numerous photographs were secured illustrative of habitats and other features of locust biology, some of which appear with this report.

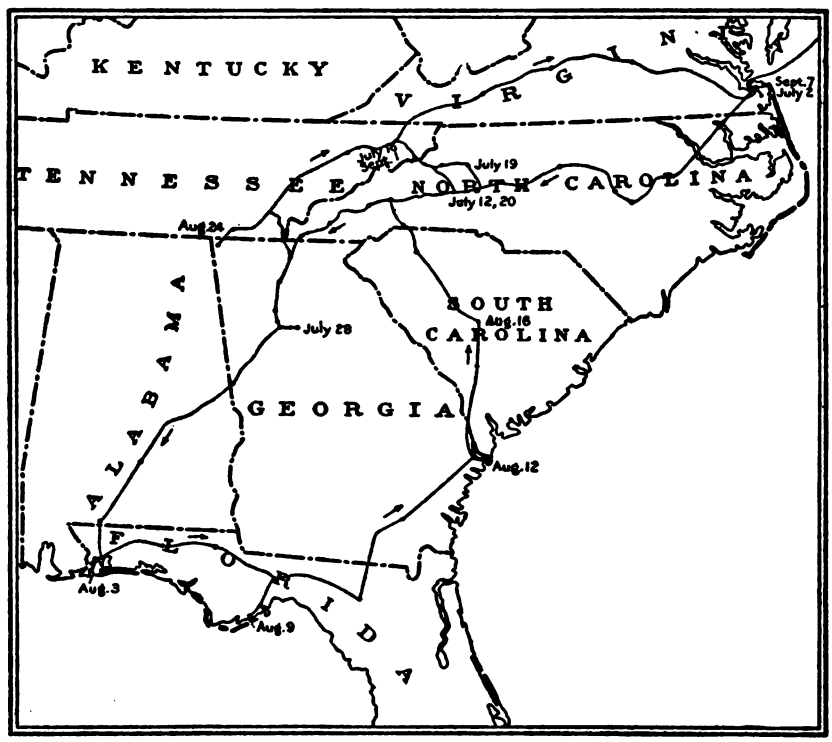


FIG. 1.—Map showing the route traveled.

FIELD WORK.

Leaving Boston by steamer on June 30, Norfolk, Va., was reached and collecting begun in its vicinity on July 2; thence southwest to Tarboro and Selma, N. C., and westward through North Carolina, stopping at frequent intervals, to Morganton, from which point a detour was made by team and rail to Pineola and Roan Mountain, returning via Linville and Blowing Rock; westward again to Asheville, the Balsam Mountains, and Murphy; southward to Atlanta; southwest to the Gulf coast at Pensacola; east through northern Florida to Tallahassee, whence the Gulf

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coast was reached a second time at Carrabelle; eastward to Live Oak; northeast via Waycross to Savannah and the Atlantic coast at Tybee Island; north and west through South Carolina to Asheville; a second trip through the valley, including stops at the Balsam and Valley mountains, and on to Chattanooga; northeast to Johnson City, from which point Roan Mountain was visited a second time, and also Linville and Grandfather Mountain; northeast and east through Virginia to Roanoke and Norfolk, returning to Boston by steamer on September 10, after ten weeks in the field. The entire distance traveled was about 4,000 miles, of which 3,000 was through the territory under observation. The map on page 10 will render the route clear at a glance.

CLIMATAL CONDITIONS AFFECTING RESULTS.

The weather, on which so much depends, was as favorable as could be expected, though in parts of the trip collecting was much interfered with at times by showers, several being not unusual in one day. The heat of the southern summer is also a factor to be reckoned with.

The writer was informed at nearly every locality during the first half of the trip, that the season was two to three weeks late. This should be taken into consideration when calculating the time of appearance of species, and attention is called to it in the proper place.

LIFE ZONES OF THE REGION VISITED.

In the region examined four life zones are represented: The Lower Austral, including the major part of the Gulf strip of the Austro-riparian division; the Upper Austral, the Transition, and the Canadian. The Austral zones cover all of the country except the higher mountains; the Transition and Canadian cover the mountains and valleys above an altitude of about 2,500 feet. No attempt was made at an accurate delimitation of these zones, owing to the rapid character of the trip, but many notes on the zonal distribution of the various species will be found in the accompanying list (p. 24). Representative species of each zone occur, but some boreal species which it was hoped to find were not observed. The Canadian zone is restricted to limited areas on the higher summits, but austral species, owing to proximity of the Austral zone, are often found within its borders. Its characteristic fauna, while numerically insignificant, is of extreme interest, being represented

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by a wingless species, *Podisma glacialis variegata*, whose presence is believed to indicate the southward extent of continuous subalpine conditions in the Glacial Epoch.

NUMBER OF BROODS.

Notwithstanding the great length of the season of active life in the Lower Austral zone, there is, so far as I have been able to learn, but one brood per annum of any species of locust inhabiting the Eastern States; at least, I have failed to secure definite proof of the occurrence of two broods in any case, though it seems not improbable that *Chortophaga viridifasciata* and possibly other species may have two broods in the extreme south. This is a point which might readily be determined by resident observers in Florida or along the Gulf coast.

Contrary to the opinion sometimes expressed, the presence of very young or of adult insects in widely separated months of the year does not prove that there are two broods per annum of that species, unless, possibly, in the extreme south, where there is no inactive winter resting season. It needs to be shown that adults appear in numbers twice per annum, alternating with two similar appearances of newly hatched young, in order to establish beyond a doubt the occurrence of two broods annually in the life history of a species.

LIFE HISTORIES.

There is much variation in individuals of the same species in the time of hatching; and in different species in their life history with reference to the seasons of the year, some passing the winter as adults, some as nymphs, but by far the most in the egg stage. *Schistocerca americana*, *Leptysma marginicollis*, and several Tettiginæ are examples of the first; in the Northern States *Chortophaga viridifasciata*, *Arphia sulphurea*, and *Hippiscus tuberculatus* are examples of the second. It seems not impossible that some long-lived species may occur as adults in every month of the year in some of the warmer zones. In reference to this point observations are needed during the entire year.

ZONAL DISTRIBUTION.

Owing to the lack, in many cases, of definite data, the following statements concerning the zonal origin and distribution of the genera of Acridiidæ of eastern North America must be regarded as purely tentative, to be corrected and revised as opportunity permits.

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They are here put forth as a suggestion and stimulus to further research.

Genera of boreal origin and distribution.—Of the genera of Acridiidæ occurring in eastern North America six are boreal: *Chloealtis*, *Stenobothrus*, *Mecostethus*, *Camnula*, *Circotettix*, *Podisma*. Of these *Mecostethus* alone is confined to the territory east of the Rocky Mountains, so far as known. *Stenobothrus*, *Mecostethus*, and *Podisma* are Old World genera, and, with *Gomphocerus*, found among the Rocky Mountains, constitute a reminder of circumpolar land communication. If to these we add *Tettix*, which is cosmopolitan, we shall have considered all the genera common to Europe and North America, with the exception of *Schistocerca*, austral in distribution, one species of which is believed to have crossed from South America to the Old World.

Genera of austral origin and distribution.—In this group are found six which are peculiar to the Gulf strip of the Lower Austral zone or its immediate vicinity: *Paxilla*, *Rhadinotatum*, *Macneillia*, *Gymnoscirtetes*, *Eotettix*, *Aptenopedes*. Besides these, *Dictyophorus*, *Arnilia*, and *Leptysma* extend further westward in the Lower Austral zone.

Others of austral origin and distribution are: *Neotettix*, *Paratettix*, *Apotettix*, *Tryxalis*, *Mermiria*, *Syrbula*, *Eritettix*, *Amblytropidia*, *Dichromorpha*, *Clinocephalus*, and *Paroxya*. Of these all but *Paratettix*, *Apotettix*, *Tryxalis*, *Mermiria*, and *Syrbula* are confined to the east. *Psinidia* and *Scirtetica*, likewise confined to the east but probably of Sonoran derivation, are doubtless of austral origin. *Dissosteira*, *Hippiscus*, *Spharagemon*, *Trimerotropis*, *Arphia*, and *Hesperotettix*, of extended distribution both latitudinally and longitudinally, are probably of austral Sonoran origin, though some species have become adapted to boreal conditions. *Chortophaga* and *Encoptolophus*, possibly *Arphia* also, there is reason to think, may have originated in the east. *Ageneotettix*, *Phœtaliotes*, and *Mestobregma* have apparently but recently entered our territory from the west and as yet occupy but a small portion of it. The place of origin of *Pseudopomala* is questionable. *Schistocerca* and *Orphulella* are undoubtedly of austral origin, though containing species which reach a high altitude and latitude. The same is true of *Tettigidea*, and possibly of *Nomotettix*,, both of which seem to be typically eastern in distribution. *Melanoplus*, the dominant North American genus, covers the continent from Labrador to Mexico, from Alaska to Florida, and contains boreal and austral, eastern and western, and humid-land and arid-land species.

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LOCUST SOCIETIES AND HABITATS.

Independently of their zonal distribution, the Acridiidæ may be arranged, according to their habits, in local groups which we call, for lack of a better name, societies or associations of species. These groups will vary more or less according to the importance attached to various environmental factors by the person arranging them. We may follow the botanists and recognize hygrophile, xerophile, and other groups, based upon distribution with reference to soil humidity. We may divide them into campestral and sylvan series, frequenting respectively open fields and savannas or forestal environments. Or we may arrange them in still other ways.

We find, it is true, species which are characteristic of these various surroundings, and others whose habitats are not so readily classified, or which, widely distributed zonally and geographically, show no especial predilection for any definite kind of environment. A complete and satisfactory classification of locust societies has yet to be made. The hurried character of the trip forbade critical study of this topic, and mention here is made of but a few of the more noticeable features connected with the subject in the territory under consideration.

The following table shows the classification in outline of the societies which I have found easily recognizable in the Eastern States, but it needs to be amplified by further study. Fuller details of distribution will be found in the list of species (p. 24).

Locust societies of eastern North America.

Geophilous division.
- Campestrian group.
 - Xerophile societies:
 - Saxicolous species.
 - Arenicolous "
 - Humicolous "
 - Hygrophile societies:
 - Humicolous species.
 - Paludicolous "
 - Limicolous "
- Sylvan group.

Phytophilous division.
- Campestrian group.
 - Xerophile societies:
 - Hygrophile "
- Sylvan group.
 - Thamnophile societies.
 - Dendrophile "

Geophilous locusts are those which freely come into direct contact with the soil and whose local distribution is largely controlled by its character. Phytophilous locusts, on the other hand, have much closer relations with the vegetal covering of the soil, be it grass or tree. This primary difference in habits is accompanied by a structural difference in the relative development of the tarsal pulvilli—large in the plant-perching species, diminutive, obsoles-

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cent or aborted in the soil-inhabiting species. In eastern North America, with few exceptions, the Tettiginæ and Oedipodinæ are geophilous; the Tryxalinæ and Acridiinæ are phytophilous. In the West, owing not only to adaptation in habits to an arid environment, but also in part to the close systematic relationship between the Tryxalinæ and Oedipodinæ, the distinctness of these two groups is less obvious.

Geophilous Division.

The geophilous species of eastern North America are with one partial exception campestral in distribution, as would naturally be expected. The exception, *Spharagemon bolli*, is an inhabitant of xerophytic forests as well as of open fields, and in the Southern States is found quite as often in the forest as on the open plain.

Campestral Geophiles.—The campestral geophilous species may be separated into two groups, showing xerophile and hygrophile tendencies, and represented respectively by the Oedipodinæ and the Tettiginæ. The former group contains rock-inhabiting, sand-inhabiting, and loam-inhabiting species; the latter is made up of moisture-loving species, frequenting damp fields, wet meadows, and the shores of streams and ponds.

Xerophilous Geophiles.—Of saxicolous or rock-frequenting species, *Circotettix verruculatus* and *Spharagemon saxatile* of the Northern States are well-known examples. These species are represented in certain parts of the South by *Trimerotropis saxatilis*, whose habitat is likewise restricted to bare ledges and rocky hills. A colony of this species is located on Stone Mountain, Georgia,* a granite mass which rises 600 feet above the surrounding plain and is almost entirely denuded of soil, whose sun-baked and torrent-washed slopes still provide a scanty existence for a few of these insects. (Pl. 2, Fig. 1.) I found it also on the summit of Sand Mountain plateau, near Trenton, Ga., frequenting the bare rock surfaces of the "glades"—openings in the forest caused by exposure or proximity to the surface of the underlying rock. (Pl. 2, Fig. 2.)

Of arenicolous or sand-dwelling species there are several. On the drifting sands of the beach at Cape Henry, Va., between the shore and the dunes, may be found *Trimerotropis maritima*, the maritime or sea-side locust, occurring coastwise from southwestern Maine at least as far as North Carolina, and also along the Great Lakes. This species is unknown from inland localities, save as noted. Its congener, *T. citrina*, however, is found throughout

* See Senate Doc. No. 84, 57th Congress, pl. XIX.

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the larger part of the austral zones of the Southeastern States wherever the physical condition of the soil presents a suitable environment, being equally as much at home on dusty roadsides, sun-beaten waste lands, and the sandy river washes of the interior as under the nodding sea oats (*Uniola paniculata*) of the Virginia cape, the palms of Tybee, or on the snow white strand at Fort Barrancas. Plate 3, Fig. 2 shows one of its inland habitats, a sandy river-wash at Morganton, N. C. (See also Pl. 3, Fig. 1, and Pl. 4, Fig. 1). On and near the coast *Psinidia fenestralis* and *Scirtetica picta* are frequently associated with it.

Hygrophilous Geophiles.—This group contains the Tettiginæ, whose local distribution is apparently controlled by the presence of conditions favoring the growth of algæ and other delicate organisms such as grow upon damp, humus-enriched soil, conditions favored by a considerable degree of moisture and a moderate exposure to light. Even the humus itself is devoured (Hancock). Among them we find species such as *Paratettix cucullatus*, frequenting the shores of ponds and streams, be they sandy or muddy; others, like *Tettigidea lateralis* (and *Tettix granulatus* of the Northern States) prefer wet meadows and swales; and some, like *Nomotettix cristatus* and some species of *Tettix*, inhabit drier soils of arenaceous loam.

Phytophilous Division.

The phytophilous locusts fall very naturally into campestral and sylvan groups.

Campestral Phytophiles.—The campestral species, like those of the geophilous series, may be arranged in hygrophile and xerophile groups, though perhaps not quite so successfully.

Xerophilous Phytophiles.—A species belonging to this group and of much interest in the Southern States is *Hesperotettix pratensis*. This locust has a very wide distribution in the western part of the country, from Texas to Washington and from California to Indiana, and was secured last summer in the Southeastern States amid conditions much resembling those of the arid West. A glance at Pl. 5, Fig. 1 will show the desert-like surroundings in which it makes its home along the Gulf shore of Florida, where it is not uncommon among the xerophytic strand vegetation represented by *Conradina canescens*, *Quercus myrtifolia*, *Ilex vomitoria*, *Baptisia villosa*, and *Ceratiola ericoides*,* the pungent aroma of the latter vividly recalling that of the creosote-bush (*Larrea*) of the Sonoran deserts.

*Plant species kindly identified by Mr. J. M. Greenman, of Harvard University.

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Hygrophilous Phytophiles.—Of the hygrophilous group, mention should be made of *Orphulella olivacea*, a species of wide range along the sea-board, recorded from Darien and the Bermudas, and known in the United States from Connecticut, New Jersey, Maryland, Georgia, and western Florida. It is the only halophilous locust of the Eastern States, being restricted to salt-marshes and the vegetation bordering brackish waters. Near Fort Barrancas, Fla., it frequents the "spear-grass" (*Juncus*) fringing the inlets, and is often accompanied by *Paroxya atlantica* and *P. floridiana*. (See Pl. 4. Fig. 2.)

The two species of *Paroxya* just mentioned are also typical hygrophiles, the former not uncommon in grassy swamps of the Gulf region, the latter widely distributed in swampy stations in both Upper and Lower Austral zones of the Eastern States, even far inland, and often accompanied by *Tryxalis brevicornis*. *Leptysma marginicollis*, also, is a common and widespread species which frequents the erect growth of rushes and sedges which so commonly margin the shores of fresh-water ponds and swampy pools. In meadows and moist fields of the Transition and Canadian zones *Stenobothrus curtipennis* finds a congenial home, often occurring in countless numbers. In the damper portions of Coastal Plain localities, where all topographic features are in low relief, and especially where campestral conditions are mixed with sylvan in the shape of tangled thickets of undershrubs and interlacing herbage (Pl. 5, Fig. 2), *Gymnoscirtetes pusillus*, *Aptenopedes sphenarioides*, *Eotettix pusillus*, *E. palustris*, and others are to be found, playing at hide and seek, as it were, among the rushes, white-tufted cotton-grass, yellow-flowered *Xyris*, pink *Sabbatia*, and tall *Sarracenias*. These species may with equal or even greater propriety be placed in the sylvan group, owing to the labyrinthine character of this environment and their adaptation thereto, as we shall see later.

Sylvan Phytophiles.—Of this group numerous representatives occur in the Southeastern States, as would naturally be expected from the wide extent of the forest and thicket covering characteristic of the humid climate. These will be considered at some length under the next topic and in a general comparison of the campestral and sylvan groups.

Mountain Habitats.

Among the mountains of the southeastern United States campestral environments are largely replaced by sylvan in consequence of the humidity of the climate; they are, however, represented by

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clearings in the valleys along the streams and by the summit and ridge "balds." The mountain slopes are generally clothed with a forest cover, either of timber or of a dense, shrubby chaparral.

The valley clearings lie in the Upper Austral or the Transition zone, according to altitude, and possess a characteristic campestrian locust fauna represented by such phytophilous species as *Melanoplus femur-rubrum* and *M. atlanis*, *Stenobothrus curtipennis*, *Orphulella speciosa*, and such geophilous species as *Dissosteira carolina*, *Encoptolophus sordidus*, *Chortophaga viridifasciata*, *Tettix ornatus*, *T. hancocki*, *T. arenosus*, *Paratettix cucullatus*, *Neotettix bolivari*, etc. The "balds" are open spaces of greater or less area situated on the summits or extending along the ridges connecting the summits and are used as pastures for stock. On Roan Mountain and adjacent summits these balds cover hundreds of acres and when not too closely grazed form sedgy lawns of surpassing beauty framed in an unrivaled setting of pink-flowered rhododendrons and dark balsam firs.

The locust fauna of these balds is for the most part the same as that of the valley clearings—campestral species of wide distribution or of boreal character, but with a distinct austral element (*Schistocerca americana*, *Neotettix bolivari*) due to the proximity of that zone. Below, and on the ridges, the balds give place suddenly or gradually to deciduous forests. (Pl. 1, Figs. 1, 2; Pl. 8, Fig. 1.)

The forested areas present two distinct kinds of habitat—trees and undergrowth—inhabited respectively by dendrophile and by thamnophile (tree-loving and thicket-loving) species. The term thamnophilous I shall apply to those dwelling amid tangled, interlacing, vegetal undergrowth, be it of woody plants or herbs, since the biological conditions presented by the two are in certain important respects essentially the same, as will be seen later. No strictly arboreal species (such, for instance, as *Melanoplus punctulatus*) were observed, though very likely occurring.

Thamnophilous Species.

All of the woodland species secured were inhabitants of undergrowth, whether found among the more open timber or that forming the sole forest-cover of the mountain-sides. The slopes of Grandfather Mountain (see Pl. 1, Fig. 2) are largely clothed with a dense, shrubby chaparral or "laurel bald" made up of laurel, rhododendron, *Menziesia*, *Leiophyllum*, etc., amid which the apterous *Podisma glacialis variegata* finds a home. Here also lives *Melanoplus*

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sylvestris, whose congener *celatus* of the Virginia mountains bears an even closer resemblance to their northern relative, *M. islandicus*.

On the borders of the clearings and balds and in the more open forests a rank growth of "ol' rich weed" (*Eupatorium*) is frequently found, sometimes covering wide areas. Here *Melanoplus amplectens* (=*blatchleyi*) is a characteristic species, and at the head of Roan Valley has extended its habitat into the higher grassy clearings, thriving in myriads among the timothy and velvet-grass (*Rhleum* and *Holcus*). (See Pl. 7, Figs. 1, 2) Many other thicket-dwelling species were secured at various elevations.

A COMPARISON OF CAMPESTRAL AND SYLVAN LOCUSTS.

Campestrian Species.—This group as a whole includes locusts of the open country, be it wet or dry, marsh or mountain, strand or crag. Here belong our commonest and best-known locusts or "grasshoppers," of which typical examples are *Melanoplus femur-rubrum* and *Dissosteira carolina*. Considered carefully, we find that all of the Oedipodinæ of the Eastern States fall into this group; of the Tryxalinæ the following genera: *Mermiria*, *Tryxalis*, *Syrbula*, *Orphulella*, *Eritettix*, *Stenobothrus*, and *Mecostethus*; of the Acridiinæ *Leptysma*, *Arnilia*, *Schistocerca*, *Paroxya*, and about fifteen species of *Melanoplus* (notably *angustipennis*, *atlanis*, *bivittatus*, *differentialis*, *extremus*, *femoratus*, *minor*, *propinquus*, *symmetricus*); and a number of the Tettiginæ.

Sylvan Species.—To this group belong primarily those species which inhabit woodlands and thickets or their borders, such as *Chloealtis conspersa*, *Podisma glacialis variegata*, *Melanoplus amplectens*, *baconi*, *fasciatus*, *huroni*, *islandicus*, *luridus*, *morsei*, *obovatipennis*, *scudderi*, *sylvaticus*, *viridipes*, and many of the new species secured during my trip—*celatus*, *sylvestris*, *carnegiei*, *decoratus*, *deceptus*, *devius*, *divergens*, *similis*, *strumosus*, and *tribulus*. To these may properly be added, as already stated, several others whose haunts are amid tangled herbaceous growths wherever found—such, for instance, as *Dichromorpha viridis*, *Macneillia obscura*, *Gymnoscirtetes pusillus*, the species of *Eotettix* and *Aptenopedes*, and several *Tettiginæ*.

When we compare the component species of these two groups—campestral and sylvan—we are at once struck with the fact that a very large majority of the former are long-winged, and of the latter are short-winged or apterous, a fact of much biological interest.

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MACROPTEROUS AND BRACHYPTEROUS SPECIES OF LOCUSTS.

The presence of apterous or brachypterous, that is to say, flightless, species of insects in a relatively large proportion is said to be characteristic of islands and alpine mountain summits; and the current explanation, that it is due to natural selection through the agency of the wind, is widely known. While not questioning the efficiency of this agent in a considerable degree with reference to islands of small area, the evidence from North American locusts requires a different explanation. According to this theory species would be likely to show a tendency toward brachypterism *along the shores of continents*. It would be interesting to make a quantitative study of variation with reference to this point, but there is no evidence at hand to indicate that such is the case. Furthermore, flying species appear to be equally as common on alpine mountain summits as flightless species, other conditions being the same.

In North America the predominant group of Acridians is the Melanopli. Of these many are brachypterous or apterous, in short, flightless. The genera *Bradynotes*, *Asemoplus*, *Podisma*, and *Paradichroplus* are typically alpine or sub-alpine in distribution and are flightless. The genera *Gymnoscirtetes*, *Eotettix*, *Aptenopedes*, *Phoetaliotes*, *Paratylotropidia*, and others are of lowland distribution and are likewise flightless. There are many flightless species of *Melanoplus*, the dominant genus of the group, which are likewise of lowland distribution, and others which are found at high elevations in mountainous regions, some above and some below timber line. In other groups there are numerous lowland genera containing only brachypterous species (*Rhadinotatum*, *Macneillia*, *Mesochloa*, *Dichromorpha*, *Clinocephalus*, *Boopedon*, *Brachystola*, *Dictyophorus*, *Pseudopomala*, etc.). Flightless genera and species are distributed impartially as to numbers over lowland and highland areas, in Austral and Boreal life zones. Some factor other than the wind must consequently be involved.

The solution of this problem lies in the arrangement of the Acridiidæ in the two groups, campestral and sylvan, and the factor involved is, adaptation of structure to habits brought about by a sylvan environment. This has caused a change in structure through disuse of the organs of flight. In short, *Brachypterism in locusts is a more complete adaptation to a leaping mode of progression brought about by life in situations where flight is difficult or impracticable, and consequently disadvantageous*. That this is the true explanation is indicated by the habits and haunts of the majority of the flightless species (sylvan surroundings or tangled undergrowth wherever

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found); by their distribution locally, horizontally, and vertically; and by the equally characteristic habits, haunts, and distribution of macropterous species as inhabitants of the open field, desert, or savanna.

The advantages of progression by flight—dispersal widely and easily effected, often aided by the wind, ease of escape from many enemies, etc., and the superiority of this mode in open lands—are evident to all. On the other hand, long wings and locomotion by flight are disadvantageous amid dense underbrush, where a leaping mode of progression has decided advantages. Organs unused or disadvantageous tend to dwindle and disappear; hence the loss of wings.

If the members of a group of locusts, be it genus or subfamily, differ widely in habits as regards these two kinds of environment—campestral and sylvan—we find a corresponding difference in wing length, as witness the genus *Melanoplus*, the group Melanopli, the subfamily Acridiinæ. On the other hand, if uniformity of habits characterizes a group, similarity of structure accompanies it, as witness the Oedipodinæ, a subfamily characteristic of open, more or less arid surroundings, inhabiting barren fields and washes, the drifting dunes of the seashore, or bare crags of mountain summits, shy and wary of approach, seeking safety in flight, and with few exceptions equipped with large and powerful wings.

BRACHYPTERISM IN OTHER ORTHOPTERA.

Among other Orthoptera apterous species are numerous both in saltatorial and non-saltatorial families. On examination we find that genera and species inhabiting trees and shrubs (*Scudderia*, *Microcentrum*, *Cyrtophyllus*, *Oecanthus*, etc.) and open grassy lands (*Conocephalus*), are prevailingly long-winged, while those inhabiting either undergrowth (*Xiphidium* in part, *Odontoxiphidium*), crevices and caves (Ceuthophili, Decticinæ, many Blattidæ, and Gryllidæ), or burrows, either of other species or of their own make (*Cryptocercus*, *Myrmecophila*, mole-crickets in part), are very likely to be apterous or brachypterous, an evident adaptation in structure to habits directly parallel with that of brachypterous locusts (cf. also ants, termites).

On close analysis it is found that Orthoptera frequenting habitats *involving passage over open spaces* of considerable extent, such as fields, between trees in forests, and bushes or thickets in deserts, are usually long-winged, flying species; and others dwelling in an environment of more or less *dense*, *intricate*, *interlacing vegetal growth*,

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be it sub-alpine or sub-tropical, in forest or swamp—or in *burrows*, *crevices*, etc.—in short, in stations where wings are not needed or are at a disadvantage, are very generally apterous or brachypterous.

Brachypterism, therefore, appears to be largely not so much a case of natural selection through the agency of the wind as an adaptation in structure to habits. The fact that the heavier-bodied female is more frequently or completely brachypterous than the male and that the tegmina in the latter sex when used as musical instruments are retained in a less degenerate condition (even when entirely useless in flight), confirms this explanation of brachypterism.

"BURNING OVER" AS A FACTOR IN DISTRIBUTION.

A factor which must seriously affect the distribution of some species is the widespread custom of "burning over" the mountains to improve the range for stock. This practice results necessarily in the destruction of much of the woody débris lying upon the ground which is used as a nidus for the eggs by *Chloealtis conspersa*, a short-winged boreal species of wide distribution in the Northern States, where it is plentiful in numbers even on the offshore islands. A very few examples of this species were found at high elevations in the mountains of western North Carolina and Virginia, and it would seem not unlikely that the custom referred to may be largely responsible for its scarcity in that region. Since the burning is usually done during the winter, or at least in the inactive season of locust life, it would affect a species having the habit of oviposition mentioned more injuriously than one ovipositing in the earth.

HYBRIDS, VARIETIES, AND OTHER TOPICS.

What is apparently a case of hybridization resembling that of *Basilarchia arthemis* and *B. astyanax* among butterflies occurs in Virginia between two species of *Trimerotropis*. *T. citrina* has been already referred to as being widely distributed in the Southeastern States, frequenting sandy areas. At Cape Henry and Virginia Beach it meets *T. maritima*, a more northern species whose range extends to North Carolina at least. Where the ranges of the two overlap, typical forms of both species are found, and intergrades of all degrees of resemblance to either occur in numbers. Were not the typical forms present it would appear to be simply intergradation, as appears to be the case in the related genus *Scirtetica*. In the latter genus *S. marmorata*, found in Massachusetts and Connecticut, differs markedly in degree of pigmentation of the wings and slightly in structure from *S. picta* of Florida; but North Carolina specimens

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are so exactly intermediate that they can be referred to neither species with certainty. If intergradation prove to be the case, the increased amount of pigmentation in the southern form is noteworthy, paralleled as it is in other genera. Additional material in series, and, if practicable, experimentation, is needed to determine the relation of these forms and the possible effect of climatic conditions.

Other topics connected with the biological study of this group of insects, such as coloration and stridulation, were given little attention, owing to the limited time for observation in the field. It is sufficient to say that many of the Oedipodinæ collected (especially *Trimerotropis*, *Scirtetica*, *Hippiscus*, *Psinidia*, and *Spharagemon*) exhibited in a high degree their customary phases of coloration for concealment when at rest (see Pl. 8, Fig. 2) and for display (recognition or sexual coloration) when on the wing, in the latter case accompanied by a crepitating flight which in itself attracts attention.

SPECIES OF ECONOMIC IMPORTANCE.

The only species met with in sufficient numbers to be of economic importance were *Schistocerca americana*, *Stenobothrus curtipennis*, *Melanoplus differentialis*, *M. atlanis*, *M. amplectens*, and possibly *Chortophaga viridifasciata*. But three localities were found where any of these were abundant enough to cause considerable damage. *Schistocerca americana* occurs throughout the entire region visited, from the seashore to the tops of the highest mountains, but was found in numbers only near Chattanooga, Tenn., where it was accompanied by *M. differentialis*. *M. atlanis* also was observed nearly everywhere and is perhaps the most dangerous, potentially, of any species inhabiting the region. It was excessively plentiful at Linville, N. C., where its numbers threaten serious injury if they continue to increase. In the high grassy coves of Roan Valley, on the south side of Roan Mountain, the fields were alive with adults and young of *M. amplectens* (*blatchleyi*) a species which is capable of doing much damage locally, but, being short-winged, is unable to extend its ravages far. *Stenobothrus curtipennis* also was very plentiful at Linville and Roan Valley.

Inquiries made as to damage by locusts elicited little definite information. A few complaints were received of injuries to tobacco leaves occasionally, and to young crops in the spring. From the description furnished and the life history of the species it is suspected that *Chortophaga viridifasciata* may be the culprit in the latter case. Any locust outbreak occurring is likely to be of rather local character and probably could be suppressed promptly at small expense.

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LIST OF SPECIES AND LOCALITIES FROM WHICH COLLECTED.

The following list includes all of the species of Acridiidæ taken during the trip, with date and place of capture and notes on habitat. References to original descriptions and bibliography have been omitted, except when such seemed especially desirable or necessary, such as those to new species secured upon the trip (already published), which form an intrinsic part of the work done under this grant.

The sequence of groups is that of Scudder's Catalogue of the Described Orthoptera of the United States and Canada (Proc. Davenport Acad. Nat. Sci., 1900).

Unless otherwise indicated the data here given refer to adult specimens. The young, when identifiable with reasonable certainty, are included also in numerous instances; but a large number cannot as yet be determined. For the purpose of elucidating life histories, the stage of development of the young, reckoning five nymph stages, is given in many cases. Data based on immature specimens are placed in parentheses. Thus "(Asheville, July 22, juv. 5)" indicates that the record for this locality is based on young in the fifth stage; "Virginia Beach, July 2, (juv. 4), Sept. 7," indicates that adults were secured on July 2 and September 7 and young in the fourth stage on July 2. The season, judging from the development of vegetation, I was informed at nearly every locality during the first half of the trip, was from two to three weeks late. This fact should be taken into consideration when estimating the time of appearance of the species in the mature state.

Statements with reference to the zonal distribution of the species usually apply simply to the territory under consideration, and must be regarded as more or less tentative, owing to the lack of adequate data. It is hoped that students and collectors will give more attention to this matter in the future and record the character of the habitat as well as the exact locality where the various species are found.

TETTIGINAE.

Nomotettix cristatus Scudd.

Virginia: Cape Henry, July 2, (juv.).
North Carolina: Asheville, July 22; (Blowing Rock, July 19, juv.); (Morganton, July 20, juv.); (Murphy, Aug. 22, juv.); Saluda, Aug. 17; (Selma, July 7, juv.).
South Carolina: Denmark, Aug. 14, 15, (juv.).
Georgia: (Sand Mountain, Aug. 25, juv.); Waycross, Aug. 11.
Florida: (Live Oak, Aug. 10, juv.).
Alabama: Flomaton, Aug. 1.

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Austral and Transition zones. Widely, rather than generally distributed. It is seemingly most at home in the damper portions of upland fields on sandy loam, under which conditions it is sometimes locally abundant in the Northern States. In the South it was found on the same kind of soil, chiefly at low elevations, the young at this season of the year decidedly outnumbering the adults.

Neotettix bolivari Hanc.

(Including *N. rotundifrons*, and probably synonymous with *Tettix femoratus* Scudd.)

Virginia: Cape Henry, July 2, Sept. 7, (juv.); Hickory, July 3; Virginia Beach, July 4, Sept 7.

North Carolina: Asheville, July 21, 22; Balsam, July 23, Aug. 20, 3000 to 4000 feet; Eure, July 5; Governor Island, Aug. 20, (juv.); Linville, July 17, 18; Morganton, July 12, 20; (Murphy, July 25, juv.); Pineola; July 13; Raleigh, July 8, 9; Roan Mountain. July 15, 5500 feet; Salisbury, July 11; Saluda, Aug. 17; Tarboro, July 6; Tunis, July 5.

South Carolina: Denmark, Aug. 15, (juv.); Spartanburg, Aug. 16.

Georgia: Bolton, July 29, (juv.); (Sand Mountain, Aug. 25, juv.); Tybee, Aug. 12; Waycross, Aug. 11, (juv.); West Point, July 30.

Florida: De Funiak Springs, Aug. 5; Live Oak, Aug. 10, (juv.); Marianna, Aug. 6, 7, (juv.); Tallahassee, Aug. 8; Warrington, Aug. 4, (juv.).

Alabama: Flomaton, Aug. 1, 2, (juv.); Greenville, July 31, (juv.).

Tennessee: Burbank, July 17; (Johnson City, Aug. 27, juv.); Morristown, Aug. 27.

Austral and Transition zones of the Southeastern States, sometimes occurring in adjoining portions of Canadian zone. Generally distributed; plentiful, sometimes abundant locally, preferring rather moist soils and sandy loam. This is one of the characteristic species of the Southeastern States, and is very common in the adult stage during the summer. The relative proportion of the long-winged and short-winged forms varies very much in different localities, a series of 152 specimens from Waycross, Ga., containing equal numbers; but the usual proportion of long-winged examples is much lower, ranging from 5 to 20 per cent.

Neotettix bolteri Hanc.

Florida: Fort Barrancas, Aug. 3; Tallahassee, Aug. 8, (juv.); Warrington, Aug. 4.

Thus far known only from Florida, but will very likely be found to occur in the Lower Austral zone of the adjoining States.

Tettix arenosus Burm.

Virginia: Roanoke, Sept. 6.

North Carolina: Asheville, July 22; Pineola, Aug. 28; Roan Mountain, July 16, Aug. 31, 5500 feet; Tunis, July 5, (juv.).

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South Carolina: Spartanburg, Aug. 16.
Florida: Marianna, Aug. 6, 7.
Alabama: Flomaton, Aug. 2.
Tennessee: Chattanooga, Aug. 24.

Austral and Transition zones, especially the former. A humicolous species widely distributed in the Eastern States, and presenting many variations in details of form and proportions.

Tettix ornatus Say.

North Carolina: Asheville, July 22; Balsam, Aug. 20, 3000 to 3500 feet; Governor Island, Aug. 20; Linville, July 17; Pineola, July 13, 14; Roan Mountain, July 16, (Aug. 31, juv.) 5500 to 6000 feet, ; Salisbury, July 11, (juv.).
Tennessee: Burbank, July 17; Morristown, Aug. 27.

Numerous young specimens of this or the following species were taken at several of the localities named above.

A boreal species common and widely distributed in the Transition and Canadian zones, having much the same haunts as *Nomotettix cristatus*, but showing a preference for a greater degree of humidity.

Tettix hancocki Morse.

Virginia: Roanoke, Sept. 6.
North Carolina: Asheville, July 21; Linville, July 17; Pineola, July 13, 14, Aug. 28; Roan Mountain, July 16, 5500 feet; Roan Valley, July 16.
Tennessee: Burbank, July 17; Morristown, Aug. 27; Roan Mountain Station, July 17.

(See note concerning young under *T. ornatus*).

A humicolous species of boreal origin, nearly related to *T. ornatus*, widely distributed in the Transition zone of the Central and Appalachian regions.

Apotettix rugosus Scudd.

Georgia: Tybee Island, Aug. 12.

Lower Austral zone. But three examples of this species were secured, in a wet meadow near Fort Screven.

Paratettix cucullatus Burm.

Virginia: Wytheville, Sept. 5.
North Carolina: Asheville, July 22, (juv.); Balsam, July 23, Aug. 19, 20; Linville, July 18; Morganton, July 20; Murphy, July 25, (juv.); (Raleigh, July 9, juv.); Salisbury, July 11; Topton, Aug 21.
South Carolina: Spartanburg, Aug. 16, (juv.).
Georgia: Blue Ridge, July 25; Bolton, July 29; Jasper, July 25, (juv.); Marietta, July 27, (juv.).
Florida: Marianna, Aug. 7, (juv.).
Alabama: Flomaton, Aug. 1; (Greenville, July 31, juv.).
Tennessee: Burbank, July 17; Roan Mountain Station, Sept. 3, (juv.).

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Austral and warmer parts of Transition zones. A widely distributed limicolous species, often occurring abundantly on the shores of ponds, pools, and streams.

Paxilla obesa Scudd.

South Carolina: Denmark, Aug. 15, (juv.).
Florida: (De Funiak Springs, Aug. 5, juv.).

Lower Austral zone. Hitherto reported only from Georgia, these captures greatly extend its known range. A very few examples were secured in wet stations near springs or swampy ground.

Tettigidea prorsa Scudd.

South Carolina: Denmark, Aug. 14, 15, (juv.).

Lower Austral Zone. A single pair and two nearly full grown young were secured on wet ground near a stagnant pool.

Tettigidea lateralis Say.

To this species are referred provisionally a considerable number of specimens from widely distributed localities. It is not impossible that two species may be included among them, but at present so little is definitely known regarding specific characters and limitations in this difficult genus that it seems wisest to await the accumulation of material and observations.

Virginia: Appomattox, Sept. 6, (juv.); Cape Henry, July 2, (juv.), Sept. 7, (juv.); Hickory, July 3; (Norfolk, Sept. 8, juv.); Roanoke, Sept 6; Virginia Beach, Sept. 7, (juv.); (Wytheville, Sept. 4, 5, juv.).
North Carolina: Asheville, July 22, (juv.); Balsam, July 23, (juv.), (Aug. 20, juv.); (Cranberry, Aug. 28, juv.); (Eure, July 5, juv.); Governor Island, Aug. 20, (juv.); Linville, July 17, 18, (juv.), (Aug. 30, juv.); Morganton, (July 12, juv.), July 20, (juv.); Raleigh, July 8, (juv.); Roan Mountain, July 16; Roan Valley, July 16; Pineola, July 13, (juv.), (Aug. 23, juv.); Salisbury, July 11, (juv.); Saluda, Aug. 17 (juv.); Selma, July 7; Tunis, July 5, (juv.).
South Carolina: Denmark, Aug. 15.
Georgia: (Jasper, July 25, juv.); Marietta, July 27; Savannah, Aug. 14, (juv.); Waycross, Aug. 11, (juv.).
Florida: Fort Barrancas, Aug. 3, (juv.); Marianna, Aug. 6, (juv.), 7; Tallahassee, Aug. 8.
Alabama: Flomaton, Aug. 1, (juv.), 2; (Greenville, July 31, juv.).
Tennessee: (Burbank, July 17, juv.); Chattanooga, Aug. 24, (juv.); Johnson City, Aug. 27, (juv.); Morristown, Aug. 27; Roan Mountain Station, Sept. 3, (juv.).

Austral and southern parts of Transition zones. The forms here included are widely and generally distributed in damp locations in the southern part of the Eastern States. Typically they differ

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markedly from the northern forms to which I have applied Harris's name (*parvipennis*), but their true relation to the latter and to each other has yet to be determined. Series of specimens captured in different localities differ much in the relative proportion of long and short winged individuals. The reason for this, whether environmental, or in some cases possibly indicating varietal differences, has yet to be discovered.

Locusts of this genus are usually found most abundantly in moist or wet meadows and marshes with soils of sandy loam, showing a preference for a habitat intermediate in degree of humidity between such species as *Nomotettix cristatus* and *Tettix ornatus* on the one hand and *Paratettix cucullatus* on the other.

Tettigidea armata Morse.

South Carolina: Denmark, Aug. 15.

Austral. A single specimen of the short-winged form of this species was secured in the same place as the examples of *Paxilla obesa* and *Tettigidea prorsa*.

TRYXALINÆ.

Rhadinotatum brevipenne Thom.

Georgia: (Savannah, Aug. 14, juv.); (Waycross, Aug. 11, juv.).
Florida: (De Funiak Springs, Aug. 5, juv.); Live Oak, Aug. 10, (juv.); (Tallahassee, Aug. 8, juv.).
Alabama: (Greenville, July 31, juv.).

The nymphs represent two early stages, but which ones cannot be determined with certainty (probably 1 and 2) until the entire series is known.

A single adult female and several young examples of this peculiar locust were secured in grassy swamps.

Tryxalis brevicornis Linn.

North Carolina: Asheville, July 22, (juv. 4, 5); Governor Island, Aug. 20; (Lenoir, on road toward Blowing Rock, about 1500 feet, July 19, juv. 3, 4, 5); (Morganton, July 12, juv. 4); (Salisbury, July 11, juv. 4, 5); Saluda, Aug. 17.
Georgia: Jasper, July 25; Marietta, July 27, (juv. 4, 5); Stone Mountain, July 28, 1000 feet, (juv. 5).
Florida: Marianna, Aug. 6.
Alabama: Greenville, July 31, (juv. 4).
Tennessee: Chattanooga, Aug. 24; Johnson City, Aug. 27.

Austral zones. Widely distributed but rather local. A campestrian species inhabiting the rank herbage of swamps, meadows, and the vicinity of streams.

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Mermiria alacris Scudd.

? *North Carolina:* (Salisbury, July 11, juv. 2).
Georgia: Waycross, Aug. 11.
? *Florida:* (Live Oak, Aug. 10, juv. 4).

The young specimens are referred to this species with some doubt.

Lower (?) Austral. Campestrian; in old fields on bunch-grass.

Mermiria bivittata Serv.

Florida: Fort Barrancas, Aug. 3.

Lower Austral. A single male was taken in the spear-grass (*Juncus*) fringing the inlet shown in Pl. 4, Fig. 2.

Mermiria intertexta Scudd.

Georgia: Tybee Island, Aug. 12, (juv. 5).

Lower Austral. This fine locust was plentiful in a swamp among the dunes near the south end of the island, inhabiting a rank growth of coarse grasses and herbage. It is a shy and active species, flying freely and far, and on alighting dodges quickly around the grass stems to escape observation, or, slipping nimbly downward and backward, seeks to hide itself.

Syrbula admirabilis Uhl.

Virginia: Appomattox, Sept. 6; Cape Henry, Sept. 7; Norfolk, Sept. 8; Roanoke, Sept. 6; Virginia Beach, Sept. 7.
North Carolina: (Eure, July 5, juv. 2, 4, 5); (Greensboro, July 10, juv. 1, 2, 3, 4); (Morganton, July 20, juv. 2, 4, 5); (Raleigh, July 8, 9, juv. 1, 2, 5); (Salisbury, July 11, juv. 3, 4); (Selma, July 7, juv. 2, 4); (Tarboro, July 6, juv. 3, 4).
South Carolina: Denmark, Aug. 14, 15, (juv. 5); Spartanburg, Aug. 16, 17, (juv. 5).
Georgia: (Bolton, July 29, juv. 5); Jasper, July 25, 26, (juv. 3, 4, 5); (Marietta, July 27, juv. 3, 5); Sand Mountain, Aug. 25; Savannah, Aug. 14, (juv. 4); Stone Mountain, July 28, (juv. 3, 4, 5); Waycross, Aug. 11, (juv. 4); West Point, July 30, (juv. 5).
Florida: De Funiak Springs, Aug. 5, (juv. 4, 5); Live Oak, Aug. 10, (juv. 5); Marianna, Aug. 6, 7, (juv. 3, 5); Tallahassee, Aug. 8, (juv. 5); (Warrington, Aug. 4, juv. 5).
Alabama: Flomaton, Aug. 1, 2, (juv. 3, 5); Greenville, July 31, (juv. 3).
Tennessee: Chattanooga, Aug. 24; (Johnson City, Aug. 27, juv. 5); Lookout Mountain, Aug. 23; Morristown, Aug. 27; Roan Mountain Station, Sept. 3, (juv. 5).

Austral zones. A widely and generally distributed campestral species, common in upland fields amid *Andropogon* and other coarse grasses.

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Eritettix sp.

Virginia: (Appomattox, Sept. 6, juv.); (Wytheville, Sept, 4, 5, juv.).
North Carolina: (Saluda, Aug. 17, juv.).
Georgia: (Sand Mountain, Aug. 25, juv.).

All the specimens are nymphs in the second and third stages.

Upper Austral. A very few examples were secured, in dry upland fields on sandy soil.

Macneillia obscura Scudd.

Florida: Live Oak, Aug. 10, (juv. 2).

Lower Austral. A rare species occurring among the low shrubbery and tangled herbage of the piney woods of Florida.

Amblytropidia occidentalis Sauss.

Numerous young specimens which I refer to this species with some doubt were secured while sweeping.

North Carolina: (Selma, July 7, juv. 1, 2).
South Carolina: (Denmark, Aug. 14, juv. 2, 4).
Georgia: (Jasper, July 26, juv. 2); (Sand Mountain, Aug. 25, juv. 2, 3, 4); (Savannah, Aug. 14, juv. 4); (Stone Mountain, July 28, juv. 2); (Waycross, Aug. 11, juv. 3).
Florida: (De Funiak Springs, Aug. 5, juv. 4); (Live Oak, Aug. 10, juv. 3, 4); (Tallahassee, Aug. 8, juv. 3, 4).

Austral zones. Widely and rather generally distributed in campestrian surroundings.

Orphulella olivacea Morse.

Georgia: Tybee Island, Aug. 12, 13, (juv. 4, 5).
Florida: Fort Barrancas, Aug. 3, (juv. 5); Warrington, Aug. 4.

A maritime species of austral origin and distribution, ranging from Darien to the Bermudas, and known on our coast from Connecticut to western Florida. It is a halophilous campestrian species found only in salt marshes or along the shores of brackish inlets, often plentiful locally. This species, with its companions *Paroxya atlantica* and *floridiana* and *Orchelimum herbaceum*, are characteristic of the *Juncus* fringes of the tidal inlets and pools of the southern coast, equally quick to seek safety in flight, or if hard pressed to drop downward into the protecting shelter at the bases of the tall, sharp-pointed culms. (See Pl. 4, Fig. 2.)

Orphulella speciosa Scudd.

Virginia: Wytheville, Sept. 4.
North Carolina: Linville, July 18.

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Transition (and Canadian ?) zone. A northern offshoot of an austral genus, adapted to more boreal conditions. It is exceedingly plentiful in the Northeastern States, but was met with only sparingly at the localities named. Campestral, inhabiting by preference grassy fields on sandy soil.

Orphulella pelidna Burm.

All the remaining adult specimens of this genus which were secured I refer to this species. Numerous immature specimens in the fourth and fifth stages, and a few younger, were also taken at many of the localities named, and probably belong chiefly or exclusively to this species. The data given below are based entirely on adults.

Virginia: Appomattox, Sept. 6; Cape Henry, July 2, Sept. 7; Hickory, July 3; Norfolk, Sept. 8; Virginia Beach, July 2, Sept. 7.
North Carolina: Balsam, Aug. 19, 3000 feet; Cranberry, Aug. 28; Eure, July 5, 6; Grandfather Mountain, Aug. 29, 5000 feet; Morganton, July 20; Murphy, July 25; Pineola, Aug. 28; Raleigh, July 8, 9; Saluda, Aug. 17; Selma, July 7; Tarboro, July 6, 7; Topton, Aug. 21, 3000 to 4000 feet; Tunis; July 5.
South Carolina: Denmark, Aug. 14, 15.
Georgia: Blue Ridge, July 25; Bolton, July 29; Jasper, July 26; Marietta, July 27; Sand Mountain, Aug. 25; Savannah, Aug. 14; Stone Mountain, July 28; Waycross, Aug. 11; West Point, July 30.
Florida: Carrabelle, Aug. 9; De Funiak Springs, Aug. 5; Fort Barrancas, Aug. 3; Live Oak, Aug. 10; Marianna, Aug. 6, 7; Tallahassee, Aug. 8; Warrington, Aug. 4.
Alabama: Flomaton, Aug. 1, 2; Greenville, July 31.
Tennessee: Burbank, July 17; Roan Mountain Station, July 17.

Austral and warmest parts of Transition zones. This is a very widely and generally distributed species in the warmer parts of the Atlantic and Gulf States; campestral, preferring moist soils of sandy loam.

Dichromorpha viridis Scudd.

Virginia: Norfolk, Sept. 8.
North Carolina: (Greensboro, July 10, juv. 4, 5); Raleigh, July 8, 9, (juv. 3, 4, 5); Salisbury, July 11, (juv. 4, 5).
South Carolina: Columbia, Aug. 16; Denmark, Aug. 14, 15.
Georgia: Savannah, Aug. 13, 14, (juv. 3, 4); Tybee Island, Aug. 12, 13; Waycross, Aug. 11, (juv. 3, 4, 5); West Point, July 30.
Florida: Live Oak, Aug. 10; Marianna, Aug. 6, (juv. 5); Tallahassee, Aug. 8; Warrington, Aug. 4.
Alabama: Flomaton, Aug. 1, 2.
Tennessee: Chattanooga, Aug. 24, (juv. 5).

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Austral zone. A very plentiful and widely distributed species occurring from southern New England to the Gulf. In New England it is most common in grassy fields on wet soil, near the margins of ponds and streams; in the South and the Central States it is more commonly found in rank herbage along ditches and streams and the edges of moist woodlands. Its haunts are thus intermediate in character between those of a campestral and a sylvan species and so likewise are the structural adaptations presented by it, a very large proportion of the females being brachypterous.

Clinocephalus elegans Morse.

Virginia: Virginia Beach, Sept. 7.
Georgia: Tybee Island, Aug. 12, 13, (juv.); Waycross, Aug. 11, (juv. 3, 4, 5).
Florida: (De Funiak Springs, Aug. 5, juv. 4); (Carrabelle, Aug. 9, juv. 5); Warrington, Aug. 4, (juv. 4).
Alabama: Flomaton, Aug. 1, (juv. 3, 4, 5).

Austral zones, coastwise. This species is not rare in grassy marshes and wet spots in the Coastal Plain at no great distance inland.

Chloealtis conspersa Harris.

Virginia: Wytheville. Sept. 4, 3300 feet.
North Carolina: Balsam, July 24, Aug. 19, (juv. 5), 5500 to 6000 feet.

Transition and Canadian zones. A very few examples of this boreal species were taken at high elevations, amid or on the edges of shrubby growths near the summit of Jones Peak and Steestachee Bald in the Balsam Mountains, and not far from the High Rocks at Wytheville. (See page 22 on "burning over" as a factor in distribution.)

Stenobothrus curtipennis Harris.

North Carolina: Balsam, July 24, 4500 to 5700 feet; Cranberry, Aug. 28; Grandfather Mountain, Aug. 29, 4500 to 5000 feet, (juv. 5); Linville, July 17, 18, (juv. 5), Aug. 30, (juv. 5); Roan Mountain July 15, (juv. 2, 3, 4), Aug. 31, Sept. 1, (juv. 5); Roan Valley, July 16, (juv. 3, 4, 5).

Transition and Canadian zones. This boreal species is plentiful in the campestral areas of the higher mountains, both in the valley clearings and on the sedgy lawns of Roan Mountain, at an altitude of 5,500 to 6,300 feet. It is a lover of moisture and its favorite haunts are in the dense and succulent growth along streams and in wet meadows and moist fields. It presents the customary variations in structure and color characteristic of the species in its northern haunts.

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OEDIPODINAE.

Arphia xanthoptera Germ.

Virginia: Norfolk, Sept. 8; Roanoke, Sept. 6; Virginia Beach, Sept. 7; Wytheville, Sept. 4, (juv. 5).

North Carolina: (Asheville, July 21, juv. 3); (Greensboro, July 10, juv. 4); (Murphy, Aug. 22, juv. 5); (Raleigh, July 9, juv. 3); (Salisbury, July 11, juv. 2, 3); (Saluda, Aug. 17, juv. 5); (Topton, Aug. 21, 3000 to 4000 feet, juv. 5).

South Carolina: Denmark, Aug. 14, (juv. 5).

Georgia: Sand Mountain, Aug. 25, 1500 feet; Waycross, Aug. 11.

Florida: De Funiak Springs, Aug. 5; (Live Oak, Aug. 10, juv. 5); Marianna, Aug. 7; Tallahassee, Aug. 8, (juv. 5).

Alabama: Flomaton, Aug. 1, (juv. 5).

Tennessee: Morristown, Aug. 27, 1400 feet; Roan Mountain Station, Sept. 3, (juv. 5).

Austral and Transition zones. Generally distributed, in old fields, pastures, and open sprout and wood-lands, preferring dry, loamy soil.

Arphia sulphurea Fabr.

Virginia: Virginia Beach, July 2, 4.

North Carolina: Balsam, July 23, 24; Blowing Rock, July 19; Linville, July 18; Tarboro, July 7.

Georgia: Jasper, July 26.

Austral and Transition zones. An early maturing species most plentiful in May and June, frequenting the same habitats as its congener *xanthoptera*.

Arphia granulata Saus.

Florida: Live Oak, Aug. 10.

Lower Austral. A single example taken.

Chortophaga viridifasciata DeG.

Virginia: (Appomattox, Sept. 6, juv. 2, 3); Hickory, July 3; Norfolk, Sept. 8; Roanoke, Sept. 6, (juv. 2, 3, 4); Virginia Beach, July 2, 4, Sept. 7, (juv. 3); Wytheville, Sept. 5, (juv. 3).

North Carolina: Asheville, July 22, (juv. 2, 4, 5); Balsam, July 23, 3500 feet (juv. 4); July 24, 4500 to 5700 feet; Aug. 20, (juv. 1, 2, 5); Blowing Rock, July 19; Cranberry, July 14, (Aug. 28, juv. 2); Governor Island, Aug. 20, (juv. 1, 2, 3); Grandfather Mountain, Aug. 29, 5500 feet; (Greensboro, July 10, juv. 4); Linville, July 18, (juv. 1), (Aug. 30, juv. 2); Morganton, July 12, (juv. 2, 4); Murphy, July 25, (juv. 2, 4, 5), Aug. 22, (juv. 1, 2); Pineola, July 13, 14, Aug. 28; Raleigh, July 9, (juv. 2); Roan Mountain, July 15, 16, Aug. 31, (juv. 1), Sept. 1, 5500 to 6200 feet; Roan Valley, July 16; Salisbury, July 11, (juv. 5); Saluda, Aug. 17, (juv. 2); Selma, July 7, (juv. 2, 3); Tarboro, July 7, (juv. 4, 5); Topton, Aug. 21, 2700 feet; Tunis, July 5.

South Carolina: (Spartanburg, Aug. 12, juv. 2).

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Georgia: Blue Ridge, July 25, (juv. 3); Bolton, July 29, (juv. 5); Jasper, July 26, (juv. 2, 4); Marietta, July 27, (juv. 3, 4, 5); Sand Mountain, Aug. 25, (juv. 2); Savannah, Aug. 14, (juv. 2, 4, 5); Stone Mountain, July 28, (juv. 2); Tybee Island, Aug. 13: Waycross, Aug. 11, (juv. 1, 2, 4, 5); West Point, July 30.

Florida: Carrabelle, Aug. 9, (juv. 5); De Funiak Springs, Aug. 5, (juv. 2); Fort Barrancas, Aug. 3, (juv. 2, 5); Live Oak, Aug. 10, (juv. 2, 5); Marianna, Aug. 6, 7, (juv. 2, 5); Tallahassee, Aug. 8, (juv. 4); Warrington, Aug. 4.

Alabama: Flomaton, Aug. 1, 2, (juv. 4, 5); Greenville, July 31, (juv. 3).

Tennessee: Chattanooga, Aug. 24, (juv. 4); Johnson City, Aug. 27, (juv. 2, 3); Lookout Mountain, Aug. 23, (juv. 3, 5); Morristown, Aug. 27, (juv. 2, 5); Roan Mountain Station, Sept. 3, (juv. 2, 3).

Austral, Transition, and Canadian zones. Very widely and generally distributed; plentiful, sometimes abundant locally, inhabiting a great variety of environments, chiefly campestral, but not infrequently found in open places in wood-lands. This is one of the most thoroughly disseminated species of the Eastern States.

Encoptolophus sordidus Burm.

Virginia: Roanoke, Sept. 6; Wytheville, Sept. 4, 5.

North Carolina: Linville, Aug. 30; (Pineola, Aug. 28, juv. 4, 5).

Tennessee: Roan Mountain Station, Sept. 3.

Austral, Transition, and Canadian zones. But few examples of this species, which is exceedingly common in the Northern States, were secured. These were taken in dry upland fields.

Hippiscus phoenicopterus Germ.

Virginia: Virginia Beach, July 2, 4.

North Carolina: Eure, July 6; Greensboro, July 10; Morganton, July 20; Raleigh, July 8; Tarboro, July 7; Tunis, July 5.

Georgia: Bolton, July 29; Jasper, July 26; Sand Mountain, Aug. 25; Stone Mountain, July 28.

Austral zones. Locally common in dry fields and pastures.

Hippiscus sp. indet.

Immature specimens of a species of this genus of uncertain identity were secured as follows:

Tennessee: (Morristown, Aug. 27. juv. 2, 3); (Roan Mountain Station, Sept. 3, juv. 2).

Hippiscus rugosus Scudd.

Virginia: (Cape Henry, July 2, juv. 3); (Hickory, July 3, juv. 4); Roanoke, Sept. 6; Virginia Beach, (July 4, juv. 3), Sept. 7; Wytheville, Sept. 4, 5.

North Carolina: (Asheville, July 22, juv. 3, 4, 5); (Eure, July 5, juv. 3); Governor Island, Aug. 20; (Greensboro, July 8, 9, juv. 3, 4); (Selma, July 7, juv. 4, 5); (Tarboro, July 6, juv. 3); (Tunis, July 5, juv. 3, 4).

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South Carolina: Denmark, Aug. 15; (Spartanburg, Aug. 17, juv. 5).
Georgia: Sand Mountain, Aug. 25; (Stone Mountain, July 28, juv. 4); West Point, July 30, (juv. 3, 4, 5).
Florida: Live Oak, Aug. 10, (juv. 4, 5).
Alabama: Greenville, July 31, (juv. 3, 4, 5).
Tennessee: Chattanooga, Aug. 24, (juv. 5); Johnson City, Aug. 27; Morristown, Aug. 27; Roan Mountain Station, Sept. 3.

Austral and Transition zones. A widely distributed and locally common species on old fields of sandy loam. There is much variation in wing coloring individually.

Dissosteira carolina Linn.

Virginia: Hickory, July 3; Norfolk, Sept. 8; Roanoke, Sept. 6; Virginia Beach, July 2; Wytheville, Sept. 4.
North Carolina: Asheville, July 22, (juv. 5); Balsam, July 23, (juv. 5); Aug. 19, (juv. 5); Blowing Rock, July 19, (juv. 5); (Cranberry, Aug. 28, juv. 5); (Eure, July 5, juv. 5); Grandfather Mountain, Aug. 29, 5000 feet, (juv. 5); Greensboro, July 10, (juv. 5); Linville, Aug. 30; Morganton, July 12, (juv. 4), July 20; Murphy, July 25, Aug. 22; Raleigh, July 9, (juv. 4); Salisbury, July 11; Selma, July 6; Topton, Aug. 20, 3000 feet; Tunis, July 5.
South Carolina: Columbia, Aug. 16; Spartanburg, Aug. 16.
Georgia: Blue Ridge, July 25; Jasper, July 26; Marietta, July 27; Sand Mountain, Aug. 25; Savannah, Aug. 13, (juv. 5).
Florida: Marianna, Aug. 6, (juv. 4).
Alabama: Flomaton, Aug. 1, (juv. 5).
Tennessee: Burbank, July 17, (juv. 5); Chattanooga, Aug. 24, (juv. 5); Lookout Mountain, Aug. 23, (juv. 5).

Austral and Transition zones. A very common species, very widely and generally distributed in sandy fields, roads, river-washes, etc.

Spharagemon collare wyomingianum Thom.

North Carolina: Eure, July 5; Tarboro, July 6, 7.

Austral zone. A half dozen examples of this species were obtained in old fields of sandy loam scantily clothed with xerophilous grasses and weeds.

Spharagemon bolli Scudd.

Virginia: Roanoke, Sept. 6; (Virginia Beach, July 4, juv. 5); Wytheville, Sept. 4, 5.
North Carolina: Asheville, July 21, 22, (juv. 5); Balsam, July 22, 23, 3500 feet; Murphy, July 25, Aug. 22, (juv. 5); Pineola, Aug. 28; Saluda, Aug. 17; Topton, Aug. 21, 3000 to 4000 feet (juv. 5).
South Carolina: Denmark, Aug. 15.
Georgia: Blue Ridge, July 25; Jasper, July 26; Marietta, July 27; Sand Mountain, Aug. 25.

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Florida: Carrabelle, Aug. 9; Tallahassee, Aug. 8.
Tennessee: Johnson City, Aug. 27; Lookout Mountain, Aug. 23; Morristown, Aug. 27; Roan Mountain Station, Sept. 3.

Austral and Transition zones. A common and very widely distributed species, in old fields, pastures, and open wood-lands on dry soil.

Spharagemon saxatile planum Morse.

Spharagemon saxatile planum. Psyche, XI, 13 (1904).

"Differing noticeably from the specific type in the structure of the pronotum, the midcarina, although of the same general form and profile, being lower throughout, and the disk of the metazone more nearly and constantly plane, instead of arched in longisection as is commonly the case in the type, especially in the female. Hind tibiæ with an increased amount of infuscation distad of the pale basal annulus, in this respect sometimes approaching *bolli* in degree. The general color of the specimens at hand is a purplish red in consonance with the tint of the soil of the habitat; the pale X mark of the pronotal disk is lacking, and even the transverse fuscous bands of the tegmina are indistinct."

Virginia: Wytheville, Sept. 4, 5, 2300 feet.

Transition zone. The specific type *saxatile* is a characteristic rock-inhabiting locust of the Northeastern States, very rarely being found away from ledges. The form here described was plentiful locally on a thinly grassed, gravelly hill-slope, accompanied by its congener *bolli*, and exactly matching in coloration the purplish red, iron-bearing fragments of rock and soil on which it made its home. The difference in coloration from *saxatile* of the Northern States is very great, the latter being deep blackish-fuscous, marbled with gray and white.

Mestobregma thomasi Caudell.

Georgia: Sand Mountain, Aug. 25; Trenton, Aug. 25.
Tennessee: Chattanooga, Aug. 24.

Upper Austral zone of Central States. This species was found locally common in sandy fields near Chattanooga, and was also taken on rocky ledges at Trenton and near Flat Rock on Sand Mountain plateau, its coloration varying according to its environment from nearly black to ashen or dust-color. It flies freely on a warm day, but weakly, and is easily captured.

Scirtetica picta Scudd.

North Carolina: Eure, July 6.
Florida: Carrabelle, Aug. 9; Fort Barrancas, Aug. 3, (juv. 4, 5); Live Oak, Aug. 10, (juv. 5); Warrington, Aug. 4.

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Lower Austral, coastwise. This is a striking and beautiful species, common in Florida, especially on the strand, where it is associated with *Psinidia fenestralis* and *Trimerotropis citrina*. (See Pl. 4, Fig. 1; Pl. 5, Fig. 1) The examples from North Carolina are so exactly intermediate in character between this species and its northern relative *marmorata* as to suggest the possibility that the two forms are but geographic races of the same species. Series of specimens from intermediate points are needed to determine the relation of these two forms.

Psinidia fenestralis Serv.

Virginia: Cape Henry, Sept. 7, (juv. 4); (Virginia Beach, July 2, juv. 3).
North Carolina: Eure, July 6, (juv. 4, 5); Tarboro, July 7.
Georgia: Tybee Island, Aug. 12, 13, (juv. 3, 5).
Florida: Carrabelle, Aug. 9, (juv. 4); Fort Barrancas, Aug. 3, (juv. 4); Live Oak, Aug. 10; Warrington, Aug. 4.

Austral and Transition zones. Widely distributed; locally common in the Atlantic States on large or small bare sandy areas.

Trimerotropis saxatilis McNeill.

Georgia: Sand Mountain, Aug. 25, near White Oak Gap and Flat Rock; Stone Mountain, July 28.

Upper Austral zone. This is a very local species which was met with but twice. It frequents the weathered surfaces of rocky ledges, which it exactly matches in coloration when at rest, closely resembling *Circotettix verruculatus* of the north in color and habits, but being smaller in size, and with a relatively very weak stridulation. (See Pl. 2, Figs. 1, 2, and pages 14, 15.)

Trimerotropis maritima Harris.

Virginia: Cape Henry, July 2, 4, Sept. 7, (juv. 3, 5); Virginia Beach, July 2, (juv. 5).

Maritime; coastwise from Maine to North Carolina, and about the Great Lakes. (See the next species.)

Trimerotropis citrina Scudd.

Virginia: Cape Henry, July 2, 4, Sept. 7; Virginia Beach, July 2, 4.
North Carolina: Governor Island, Aug. 20; Greensboro, July 10; Morganton, July 20, (juv. 5); Murphy, Aug. 22; Salisbury, July 11; Selma, July 7; Tarboro, July 7, (juv. 4); Tunis, July 5.
South Carolina: Columbia, Aug. 16, (juv. 5).
Georgia: Marietta, July 27; Stone Mountain, July 28; Tybee Island, Aug. 12, 13, (juv. 2).
Florida: Carrabelle, Aug. 9, (juv. 4, 5); Fort Barrancas, Aug. 3, (juv. 4, 5); Marianna, Aug. 7; Warrington, Aug. 4.
Alabama: Flomaton, Aug. 1; Greenville, July 31.
Tennessee: Chattanooga, Aug. 24.

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Austral zones. A characteristic xerophilous species widely and generally distributed throughout the Southeastern States. Along the seaboard in North Carolina and Virginia it meets, mingles with, and apparently hybridizes with its northern congener, *T. maritima*. (See Pl. 3, Figs. 1, 2; Pl. 4, Figs. 1, 2; Pl. 5, Fig. 1, for illustrations of habitats, and pages 15 and 22 for further remarks on these two species.)

ACRIDIINÆ.

Dictyophorus reticulatus Thunb.

South Carolina: (Denmark, Aug. 15, juv.).
Georgia: (Waycross, Aug. 11, juv.).
Florida: (De Funiak Springs, Aug. 5, juv.).

Lower Austral zone. A few young nymphs which I refer to this species with some doubt were obtained while sweeping at the localities named.

Arnilia chlorizans Walk.

Georgia: Waycross, Aug. 11.

Lower Austral zone. A single specimen, in company with *Leptysma marginicollis*, q. v.

Leptysma marginicollis Serv.

Virginia: Cape Henry, July 2, (juv. 2, 3, 4, 5), Sept 7, (juv. 4. 5).
North Carolina: (Raleigh, July 9, juv. 2).
South Carolina: (Denmark, Aug. 15, juv. 3, 4).
Georgia: (Savannah, Aug. 14, juv. 4); (Stone Mountain, July 28, juv. 1, 2, 3); (Waycross, Aug. 11, juv. 4).
Florida: (Carrabelle, Aug. 9, juv. 4, 5); (Warrington, Aug. 4, juv. 3).

Austral zones. Locally common in the coarse, erect growth of rushes, sedges, etc., bordering the shores of fresh-water ponds, pools, and streams. Probably hibernates in the adult stage.

Schistocerca americana Drury.

Adult specimens only of this genus have been identified; the data given below are limited to these.

Virginia: Hickory, July 3; Virginia Beach, July 2, Sept 7.
North Carolina: Asheville, July 22; Governor Island, Aug. 20; Greensboro, July 10; Raleigh, July 9; Roan Mountain, July 15, Sept. 2, 5800 to 6300 feet; Salisbury, July 11; Tarboro, July 6, 7.
South Carolina: Denmark, Aug. 15.
Georgia: Bolton, July 29; Marietta, July 27; Savannah, Aug. 14; Tybee Island, Aug. 12, 13; Waycross, Aug. 11.
Florida: Marianna, Aug. 6; Tallahassee, Aug. 8.
Alabama: Flomaton, Aug. 2.
Tennessee: Chattanooga, Aug. 24; Morristown, Aug. 27.

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Austral zones, but owing to its powerful flight of common occurrence also in southern parts of Transition and Canadian zones. Generally distributed from sea-beach to summits of highest mountains, frequenting a great variety of habitats. Most plentiful in tall growths of weeds and bushes, but found in injurious numbers only in vicinity of Chattanooga in rank growth of bottom-land.

Schistocerca alutacea Harr.

South Carolina: Denmark, Aug. 15.
Georgia: Savannah, Aug. 14; Tybee Island, Aug. 12, 13.
Florida: Carrabelle, Aug. 9; Fort Barrancas, Aug. 3.

Austral zones, including southern New England. Widely distributed, but local. A common inhabitant of the rank mixed growth of grassy swamps.

Schistocerca rubiginosa Scudd.

Virginia: Cape Henry, Sept. 7; Virginia Beach, Sept. 7.
South Carolina: Denmark, Aug. 15.
Georgia: Tybee Island, Aug. 12, 13.
Florida: Carrabelle, Aug. 9; Tallahassee, Aug. 8.

Austral and Transition zones. Widely but locally distributed; sometimes associated with *S. alutacea*, but typically found in drier haunts. There is considerable variation in this species in color and markings in the direction of *alutacea*. Possibly hybrids occur, but typically these two species differ in color, structure, and haunts.

Schistocerca damnifica Saus.

Virginia: Virginia Beach, Sept. 7.
North Carolina: Tarboro, July 7.

Austral zones. But two adults of this species were seen.

Gymnoscirtetes pusillus Scudd.

Georgia: Waycross, Aug. 11, (juv.).
Florida: De Funiak Springs, Aug. 5.

Lower Austral zone. This peculiar species was found locally abundant at Waycross in the open lower, marshy portions of the pine barrens, inhabiting a matted growth made up of pipewort, sedge, and juncus stems. A single specimen taken at De Funiak Springs was found in a similar growth in a springy run. At both places it was accompanied by *Aptenopedes sphenarioides*. (See Pl. 5, Fig. 2).

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Eotettix palustris Morse.

Eotettix palustris. Psyche, XI, 7 (1904).

"Intermediate in size and appearance between *signatus* and *pusillus*. Facial costa widest opposite base of antennæ, equalling interspace between eyes, with convex sides convergent above and below, subparallel in lowest portion. Tegmina broadly oval with rounded apex, shorter than pronotum. Abdomen of male less upturned at tip than in *pusillus;* furcula well-developed, flattened or digitate; supra-anal plate triangular, its breadth nearly or quite equaling its length, the apex rounded, acute. Cerci conical, slender, tapering evenly, about three times as long as their basal width.

"Color light yellowish green, brown above and on tegmina, with fuscous post-ocular stripes from eyes to tegmina. Hind tibiæ red with black spines. This species and *signatus* agree in lacking the fuscous markings on the abdomen characteristic of *pusillus*, and in possessing red hind tibiæ. In *signatus* the apex of the supra-anal plate is usually very bluntly rounded, and the tegmina are as long or longer than the pronotum, broad lanceolate, with acute apex.

"Length of body: male, 15–15.5; female, 21.5; hind femora: male, 10; female, 14; antenna: male, 8; female, 9; tegmina: male, 2×3.5 to 2.8×4; female, 3.5×5 mm."

Florida: Live Oak, Aug. 10.

Lower Austral. This agile little species was found in the scrubby undergrowth of palmettoes and bushes in the damper spots of the piney woods.

Eotettix pusillus Morse.

Eotettix pusillus. Psyche, XI, 7 (1904).

"A diminutive species readily distinguished from *signatus* by its size and nearly circular tegmina. Facial costa widest between antennæ, nearly equalling interspace between eyes, with parallel sides, abruptly narrowed below the median ocellus to two-thirds of its width above. Disk of pronotum tectiform, distinctly convex in longisection, the mid-carina very pronounced, the lateral carinæ faintly indicated on the prozone, obsolete on metazone. Tegmina broadly obovate or sub-circular, two-thirds or three-fourths as long as the pronotum. Tip of male abdomen upturned, supra-anal plate triangular, nearly or quite as broad as long, pointed at apex, with sinuous sides. Furcula well developed, consisting of two broad flattened lobes as long as or longer than the last dorsal segment. Cerci subconic, shorter than supra-anal plate, two to three times

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as long as the width of base; acuminate, stout at base, tapering to a slender tip.

"General color pale yellowish green, dorsum and tegmina dull yellowish brown. Lateral stripes on the sides of the prozone, more or less of the bases of the abdominal segments and genicular lobes of the hind femora, apex of hind tibiæ, tibial spines and tarsal claws, black. Hind tibiæ colored like the body.

"Length of body: male, 10-12; female, 16-17; hind femora: male, 7.5-8; female, 9.5-11; antenna: male and female, 8-8.5; tegmina: male, 1.7×2 to 2×2.5; female, 3×3.5 to 3.3×4 mm."

South Carolina: Denmark, Aug. 15.

Georgia: Waycross, Aug. 11.

Lower Austral. (See note on habitat under *Gymnoscirtetes pusillus*.)

Hesperotettix floridensis Morse.

Georgia: Waycross, Aug. 11.

Lower Austral. A single female only was obtained.

Hesperotettix brevipennis Thom.

Georgia: Sand Mountain, near Flat Rock, Aug. 25.

Upper Austral (?) zone. This species is known only from eastern Massachusetts, New Jersey, and Georgia. It is exceedingly local. In Massachusetts it is found on bunch-grass (*Andropogon scoparius*), in New Jersey it is reported from cranberry bogs. A single pair were taken on the Sand Mountain plateau on bunch-grass in open deciduous woods.

Hesperotettix pratensis Scudd.

Florida: Carrabelle, Aug. 9; Fort Barrancas, Aug. 3; Warrington, Aug. 4.

Austral zones, from Florida and Indiana westward. (See page 16 for remarks on the habitat of this species, and Pl. 5, Fig. 1.)

Podisma glacialis variegata Scudd.

Podisma variegata Scudd. Rev. Mel., 97, 101.

Podisma glacialis variegata. Walker, Can. Ent., Nov., 1903.

North Carolina: (Balsam, Aug. 19, Jones Peak, 5800 feet., juv.); Grandfather Mountain, Aug. 29; (Pineola, July 14, juv.); Roan Mountain, Sept. 1.

Canadian and colder part of Transition zones. This locust seems to be rather widely distributed in the higher parts of the North Carolina mountains, inhabiting shrubby undergrowth and thickets of weeds and bushes throughout the mountains. (Pl. 1, Figs. 1, 2.) It is a sluggish and secretive species and but few examples were observed. It should be looked for on the Virginia mountains above an altitude of 3,000 feet.

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MELANOPLUS.

In this extensive genus I have not attempted to determine the immature specimens save in a few cases; the records here given refer to adults. For convenience of treatment in this place I have divided the genus primarily into two series—long-winged and short-winged species. The species are arranged, in the main, according to the sequence of Scudder's Revision of the Melanopli.

It is a significant fact in its bearing on distribution that but one of the long-winged species captured was undescribed, while no less than eleven short-winged species of this and two of the allied genus *Eotettix* proved to be new. This fact indicates the local distribution, secretive habits, and less explored haunts of the short-winged species.

A. Long-winged Series.

Melanoplus atlanis Riley.

Virginia: Appomattox, Sept. 6; Cape Henry, July 2; Hickory, July 3; Norfolk, Sept. 8; Roanoke, Sept. 6; Virginia Beach, July 2, Sept. 7; Wytheville, Sept. 4.

North Carolina: Asheville, July 22; Balsam, July 23, 24, Aug. 20, 3000 to 5700 feet; Blowing Rock, July 19; Cranberry, July 14; Governor Island, Aug. 20; Grandfather Mountain, Aug. 29; Greensboro, July 10; Linville, July 17, Aug. 30; Morganton, July 12, 20; Murphy, Aug. 22; Pineola, July 13, 14, Aug. 28; Raleigh, July 9; Roan Mountain, July 16, Aug. 31, Sept. 1, 6200 feet, (juv.); Roan Valley, July 16; Salisbury, July 11; Saluda, Aug. 17; Selma, July 7; Tarboro, July 6; Tunis, July 5.

South Carolina: Columbia, Aug. 16; Spartanburg, Aug. 16.

Georgia: Bolton, July 29; Jasper, July 25; Sand Mountain, Aug. 25; Stone Mountain, July 28; West Point, July 30.

Florida: Marianna, Aug. 6.

Alabama: Flomaton, Aug. 2.

Tennessee: Burbank, July 17; Chattanooga, Aug. 24; Johnson City, Aug. 27; Lookout Mountain, Aug. 23; Morristown, Aug. 27.

Austral, Transition, and Canadian zones, from Atlantic to Pacific. This locust is probably the most widely and generally distributed of all inhabiting the Southeastern States, breeding from sea-level to the summit of Roan Mountain. While most at home in dry, grassy fields, it is likely to be found anywhere. It was abundant at Linville, as previously noted, and threatens serious damage in that locality if it continues to increase. Elsewhere it was not plentiful though probably occurring in nearly all of the localities visited.

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Melanoplus impudicus Scudd.

North Carolina: Murphy, July 25.
South Carolina: Denmark, Aug. 15; Spartanburg, Aug. 16.
Georgia: Blue Ridge, July 25; Sand Mountain, Aug. 25.

Austral zones. A widely distributed but apparently local species ranging in the austral zones from New Jersey on the Atlantic slope southward, through South Carolina and Georgia, northward into Indiana. The specimens taken were found in dry, grassy fields, an environment very similar to that preferred by *atlanis*.

Melanoplus femur-rubrum DeG.

Virginia: Appomattox, Sept. 6; Norfolk, Sept. 8; Roanoke, Sept. 6; Virginia Beach, Sept. 7; Wytheville, Sept. 4.
North Carolina: Cranberry, Aug. 28; Governor Island, Aug. 20; Grandfather Mountain, Aug. 29; Linville, Aug. 30; Roan Mountain, Sept. 1; Topton, Aug. 21, 3000 feet.
Georgia: Sand Mountain, Aug. 25; Stone Mountain, July 28; West Point, July 30.
Alabama: Flomaton, Aug. 2.
Tennessee: Chattanooga, Aug. 24; Johnson City, Aug. 27; Morristown, Aug. 27; Roan Mountain Station, Sept. 3.

Lower Austral in part, Upper Austral, Transition, and Canadian zones, in humid campestral stations. This species is much less plentiful and less generally distributed as a whole in the Southern than in the Northern States, and in the Gulf strip of the Lower Austral gives place to the next species, *propinquus*. The Flomaton specimens are intermediate between the two species in length of furcula and form of cerci, though perhaps more closely approaching *femur-rubrum*. The largest examples of this species which I have ever seen are those obtained at Norfolk.

Melanoplus propinquus Scudd.

South Carolina: Denmark, Aug. 15.
Georgia: Savannah, Aug. 14; Tybee Island, Aug 12, 13.
Florida: De Funiak Springs, Aug. 5; Fort Barrancas, Aug. 3; Live Oak, Aug. 10; Marianna, Aug. 6; Tallahassee, Aug. 8; Warrington, Aug. 4.

Lower Austral zone, Gulf Strip. Campestral, in grassy fields, meadows, and swamps.

Melanoplus luridus Dodge.

Virginia: Roanoke, Sept. 6; Wytheville, Sept. 4, 5.
North Carolina: Linville, Aug. 30; Murphy, Aug. 22; Pineola, Aug. 28; Roan Mountain, Sept. 1, 5000 to 5500 feet; Saluda, Aug. 17; Topton, Aug. 21, 3000 to 4000 feet;
Georgia: Sand Mountain, Aug. 25.
Tennessee: Chattanooga, Aug. 24; Johnson City, Aug. 27; Lookout Mountain, Aug. 23.

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Upper Austral and Transition zones. This species is most plentiful in or near sylvan habitats, being found usually in or on the borders of dry, open woodlands, groves, and thickets. It is an expert leaper, using its legs as a means of escaping its enemies quite as freely as its wings, though flying freely on occasion. It is interesting to note, in this connection, that its wings are distinctly abbreviated as compared with those of purely campestrian species such as *femur-rubrum* and *atlanis*.

Melanoplus deletor Scudd.

South Carolina: Denmark, Aug. 14, 15.

Lower Austral zone. Locally common in shrubbery among pines near swampy ground.

Melanoplus differentialis Uhler.

Tennessee: Chattanooga, Aug. 24.

Austral zones, almost exclusively west of the Appalachians. This species was found in considerable numbers in the rank vegetation of the bottom-land along a creek, where it was accompanied by *Dichromorpha viridis*, *Tryxalis brevicornis*, and *Schistocerca americana*.

Melanoplus symmetricus Morse.

Melanoplus symmetricus. Psyche, XI, 8 (1904).

"A long-winged species allied to *robustus*. Furcula wanting. Cerci stout at base, laminate and a little incurved at tip, broad, nearly symmetrical, the basal half or three-fifths a little longer than wide, with subequal, subparallel sides; the distal half or two-fifths broadened equally above and below into a transverse plate with axis perpendicular to that of the stem, its length one and two-thirds times the width of the stem, the apex smoothly convex (sometimes sinuous through extension of lower angle of lobe), the proximal sides straight and leaving the stem at an angle of 30° or 40°, the dorsal portion of the plate slightly broader and its angle more rounded than the lower.

"General color brownish testaceous; hind tibiae red with black spines. Hind femora stout, flavous on outer lower face, coral red within on basal two-thirds, often showing indications of oblique fuscous fasciae.

"Length of body: male, 28–30; female, 31–34.5; hind femora: male, 16–18; female, 19–20; antenna: male, 13.5–14.5; female, 11–14; tegmina: male, 20–22; female, 21–23; vertex to tip of tegmina: male, 30–31.5; female, 30.5–33.5 mm."

(See Fig. 10, p. 46—drawing of male cercus.)

Florida: Carrabelle, Aug. 9.

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Gulf strip of Lower Austral, coastwise. The type specimens were secured in a grassy swamp not far from the beach (see Pl. 6, Fig. 2) and were associated with *Paroxya atlantica* and *floridiana* and *Schistocerca alutacea*. It is a campestral species resembling *femoratus* in size, appearance, and haunts, save for some minor differences in coloring.

Melanoplus femoratus Burm.

Virginia: Appomattox, Sept. 6; Virginia Beach, July 4.
North Carolina: Asheville, July 22; Balsam, Aug. 20, 3000 to 4000 feet; Murphy, July 25; Salisbury, July 11; Topton, Aug. 21, 2800 feet.
Georgia: Blue Ridge, July 25; Sand Mountain, Aug. 25.

Upper Austral and Transition zones. A campestral species frequenting the rank grass and herbage in swamps and along streams.

B. SHORT-WINGED SERIES.

Melanoplus scudderi Uhler.

Virginia: Roanoke, Sept. 6; Virginia Beach, Sept. 7; Wytheville, Sept. 4.
Georgia: Trenton, Aug. 25.
North Carolina: Chattanooga, Aug. 24; Morristown, Aug. 27.

Austral and Transition zones. Widely distributed but local. Sylvan in habitat, frequenting borders of woodlands, thickets, and tangles on rather dry soil.

Melanoplus carnegiei Morse.

Melanoplus carnegiei. Psyche, XI, 10 (1904).

"A short-winged species related to and resembling *scudderi* but with the cerci shorter, about as long as their basal breadth, equalling three-fifths of the supra-anal plate, triangular, acutely pointed, the sides straight or a little sinuous by reason of convexity of base; the ventral margin is usually the longer, but sometimes the sides and base are subequal; thick at base, tapering evenly to the not at all incurved apex. Subgenital plate scoop-shaped, the end pointed, the apex rounded or slightly truncate. Furcula minute, barely discernible, scarcely half as long as last segment. Supra-anal plate triangular, longer than wide, pointed, the sides convex.

"Pronotum resembling that of *scudderi* but scarcely as wide posteriorly; prosternal spine very variable, sometimes cylindrical and bluntly pointed, more usually flattened antero-posteriorly, apex broad and bluntly rounded or acute with straight sides. Tegmina shorter than in *scudderi*, nearly as long as pronotum, broad lanceolate with rounded apex, attingent or slightly overlapping.

"Color and markings as in *scudderi*, the hind tibiae red.

"Length of body: male, 14–17.5; female, 23–24; hind femora:

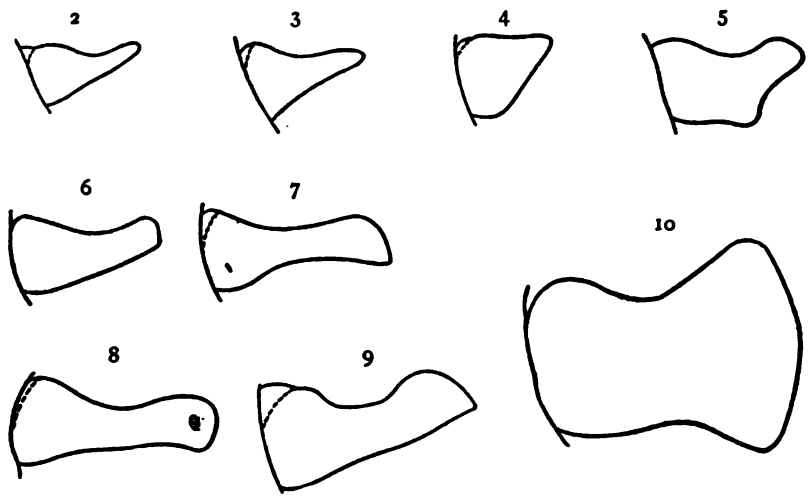
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male, 10–12, female, 13.5–14.5; antenna: male, 7–8.5; female, 8.5–10; tegmina: male, 2.5 × 4, 3 × 4.5; female, 3.5 × 6 mm."

(See Fig. 4—drawing of male cercus.)

South Carolina: Denmark, Aug. 15; Spartanburg, Aug. 16.
Georgia: Blue Ridge, July 25.

Austral zones. Sylvan in habitat, occurring in the undergrowth in pine woods.



FIGS. 2–10, Cerci of *Melanoplus*, male: 2, *M. sylvestris;* 3, *M. celatus;* 4, *M. carnegiei;* 5, *M. divergens;* 6, *M. similis;* 7, *M. tribulus;* 8, *M. devius;* 9, *M. deceptus;* 10, *M. symmetricus.* (Magnified 16 diameters).

Melanoplus celatus Morse.

Melanoplus celatus. Psyche, XI, 10 (1904).

"Closely related to *M. islandicus*, agreeing with it in size, coloration, markings and form with the following exceptions:

"Cerci of male similar to those of *islandicus*, stout at base, tapering equally, or more rapidly in basal portion, to a slender, flattened tip, once and a half or twice as long as width of base, symmetrical, the tip not bent upward nor grooved externally as usual in *islandicus*. Subgenital plate averaging shorter on the dorsal margin than in *islandicus*. Prosternal spine conic or cylindroconic, the apex blunt, well-rounded,—in *islandicus* subpyramidal, acutely pointed, the sides flattened."

(See Fig. 3—drawing of male cercus.)

Virginia: Wytheville, Sept. 4, 5, 3000 to 3500 feet.

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Transition zone. Sylvan, in shrubby growth among pines on dry, stony soil. The types were taken in the vicinity of the High Rocks.

Melanoplus sylvestris Morse.

Melanoplus sylvestris. Psyche, XI, 10 (1904).

"This species also is a near relative of *islandicus* Blatchl., differing chiefly in the form of the male cerci, which, while of the same general structure, are narrower at base and have the distal half bent slightly upward and drawn out into a slender, compressed, substyliform tip, the whole appendage being once and three-quarters or twice as long as the width of base. The prosternal spine is very variable, ranging from subcylindrical with bluntly rounded tip to a more usual conical form with rounded apex.

"Seven males, seven females, Blowing Rock, Watauga Co., N. C., July 19. Two females, Linville, Mitchell Co., N. C., July 18. Six males, six females, Loverings', Burke Co., (between Morganton and Pineola), July 13. Two females, Pineola, Mitchell Co., N. C., July 13; one male (?) same place, Aug. 28. All at elevations of 3500 to 4000 ft.

"The three species,—*islandicus*, *celatus*, and *sylvestris*—are evidently nearly related descendants of the same parent form, modified by isolation. Intergrades may yet be discovered. The male from Pineola is included with some doubt owing to differences in structure and season."

(See Fig. 2, p. 46—drawing of male cercus.)

North Carolina: Blowing Rock, July 19; Linville, July 18; Lovering's, July 13; Pineola, July 13, Aug. 28.

Transition zone in its colder parts. Sylvan, inhabiting cold deciduous forests, where it leaps actively about among the undergrowth of *Vaccinium*, *Gaultheria*, *Galax*, etc.

Melanoplus similis Morse.

Melanoplus similis. Psyche, XI, 9 (1904).

"Very similar to *viridipes* and *deceptus*. The tip of the abdomen is less clavate and upturned, the basal half of the cerci tapers rapidly on the dorsal side to less than half the width of the base, sides of distal half parallel, apex transversely excised, the angles rounded, the dorsal one slightly more prominent; the ventral margin is nearly straight, though slightly concave and sinuous, the dorsal margin strongly concave in the middle, convex at base.

"In color and markings this species strongly resembles *viridipes* and *deceptus*, but possesses distinctive characters in the markings of

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the abdomen (as well as in the form of the cerci). In this species the subgenital plate is shining black, the preceding sternite greenish white with a very broad triangular fuscous spot extending across its posterior margin below the upturned subgenital plate from which it is separated by a lenticular pale space along the suture. In *deceptus* and *viridipes* the anterior margins of several of the abdominal sterna are conspicuously infuscated as well as both margins of the sternite preceding the subgenital plate."

(See Fig. 6, p. 46—drawing of male cercus.)

North Carolina: Murphy, July 25, 1800 feet.

Upper Austral or Transition zone. Sylvan, in dry upland forests of pine and oak on high ground.

Melanoplus deceptus Morse.

Melanoplus deceptus. Psyche, XI, 9 (1904).

"*Melanoplus viridipes* in part. Scudder, Rev. Melanopli, p. 255.

"Agreeing with *viridipes* in size, color, and markings, but differing in the form of the cerci; in *viridipes* these organs taper somewhat regularly to the apex; in this species more or less of their distal third is distinctly broadened dorsally and obliquely excised at the end, the apex being acute and ventral; the ventral margin may be convex, straight, or slightly sinuous, the dorsal margin is concave in the mesial portion, sometimes strongly so. The whole organ varies much in breadth in different specimens.

"Owing to its strong resemblance to *viridipes* this species has been confused with it by various authors and a specimen was included with the types of that species. The original descriptions and drawings, however, accurately delimit *viridipes* from this and the succeeding species."

(See Fig. 9, p. 46—drawing of male cercus.)

North Carolina: Balsam, Aug. 19, 5700 to 6100 feet, Jones Peak.

Georgia: Jasper, July 26, 2600 feet, extreme summit of Sharptop Mountain.

Transition zone. Sylvan; in deciduous forests at high elevations.

Melanoplus tribulus Morse.

Melanoplus tribulus. Psyche, XI, 11 (1904).

"A short-winged species of medium size. Disk of pronotum somewhat convex above, once and a half (female) or twice (male) as long as wide, mid-carina percurrent, distinct, lateral carinæ obsolete, hind margin a little convex, emarginate. Prosternal spine prominent, conical, acutely pointed, in female somewhat flattened antero-posteriorly. Tegmina broadly ovate, about three-fourths as

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long as pronotum. Male abdomen subclavate, considerably upturned. Subgenital plate with the sides much expanded basally, the ventral face very short, convex, terminating in a very short, blunt, upwardly directed fuscous tubercle distinctly removed from the inner margin. Supra-anal plate shield-shaped, with convex sides, abruptly narrowed to terminate in an acute point with straight sides. Furcula consisting of a pair of small, straight, flattened, backwardly directed, rather distant processes, about as long as the last dorsal segment. Cerci slender, three times as long as basal width, tapering in basal third to about half the basal width, equal in middle fourth, expanding a little distally into a laminate, obliquely excised tip, the upper angle rounded, the lower acutely pointed, the whole organ gently incurved and the tip slightly decurved.

"Color dark reddish brown above, white and flavescent beneath. Post-ocular stripe continued into fuscous of sides of abdomen, sometimes suffusing the metepisternal pale fascia. Hind femora with fuscous genicular lobes and indications of oblique fascia. Hind tibiae fuscescent glaucous with black spines.

"Length of body: male, 18.5–19; female, 26; hind femora: male, 10.5; female, 12.5; antenna: male, 10.5; female, 8; tegmina; male, 3.5–4.3; female, 4.5 mm."

(See Fig. 7, p. 46—drawing of male cercus.)

Georgia: Jasper, July 26, 2600 feet, summit of Sharptop Mountain.

Transition zone. Sylvan; in highland forests.

Melanoplus devius Morse.

Melanoplus devius. Psyche, XI, 12 (1904).

"This species is nearly related to *tribulus* here described, agreeing with it in size, form, and shape of subgenital plate. Mid-carina of pronotum percurrent. Prosternal spine typically cylindroconic and rather bluntly pointed. Furcula small and very variable. Supra-anal plate usually distinctly ampliate basally. Cerci narrow from a broad base, two and a half times as long as basal breadth, tapering gently in both breadth and thickness in basal half, the distal half equal or a little expanded apically, laminate, transversely excised at apex, the upper angle more rounded than the lower, the dorsal margin sinuous, the ventral concave. The fuscous markings of the end of the abdomen of the male readily distinguish it from *tribulus;* in this species the posterior face of the apical tubercle and the sides of the subgenital plate, the sides and anterior and posterior margins of the preceding sternite, are infuscated. In the female the sides of the abdomen are nearly free from fuscous markings. Hind tibiæ glaucous with black spines.

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"Length of body: male, 17–20; female, 22–26.5; hind femora: male, 10–11.5; female, 11.5–13; antenna: male, 9–10; female, 7.5–8.5; tegmina: male, 2 × 2.5, 2.5 × 4; female, 2.8 × 3.5, 3 × 5 mm."

(See Fig. 8, p. 46—drawing of male cercus.)

Virginia: Wytheville, Sept. 4, 5, 3000 to 3500 feet, near the High Rocks.
North Carolina: Topton, Aug. 21, 3000 to 4000 feet.

Transition zone. Dry mountain forests.

Melanoplus amplectens Scudd.

Melanoplus amplectens. Scudder, Rev. Mel., p. 260, pl. XVII, fig. 7.
Melanoplus blatchleyi. Scudder, Rev. Mel., p. 332, pl. XXI, fig. 10.

Virginia: Wytheville, Sept. 4, 5.
North Carolina: Balsam, July 24, Aug. 19, 4500 to 6000 feet; Cranberry, Aug. 28; Linville, July 18, Aug. 30; Roan Mountain and Roan Valley, Aug. 31, Sept. 1; Topton, Aug. 21, 3000 to 4000 feet.
Georgia: Jasper, July 26, 2600 feet, Sharptop Mountain.

Transition zone of Central and Appalachian regions. This is a characteristic and dominant species among the mountains of western North Carolina, inhabiting thickets of shrubbery, and herbage in and near deciduous woodlands at high elevations and sometimes extending its habitat into the adjoining fields. The cerci and furcula of the male are very variable in size and proportions, but there seems no doubt that the two names have been applied to the same species, which has a wide range in the Central States and is exceedingly plentiful in places as well as widely distributed in the southern Appalachians. Adults of this species begin to appear in small numbers about the middle of July, but the great majority do not reach maturity until August and young are still plentiful in September at high elevations.

(See Pl. 1, Fig. 1; Pl. 7, Figs. 1 and 2.)

Melanoplus attenuatus Scudd.

South Carolina: Denmark, Aug. 15, (juv. 5).

Lower Austral zone. A single male and three nymphs were secured in tangled growth on swampy ground.

Melanoplus australis Morse.

Melanoplus australis. Psyche, XI, 13 (1904).

"Related to *attenuatus*. Tegmina lanceolate with rounded tip,—in *attenuatus* elliptical, and almost truncate at apex. Furcula processes well-developed, broad at base, tapering (chiefly on inner side) to digitate tips, one-third as long as supra-anal plate,—in *attenuatus* one-fourth or less. Supra-anal plate resembling that of

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attenuatus, showing indications of the marginal dentate plication of that species. Cerci slender, very nearly symmetrical, three times as long as broad, the middle third narrowed to one-half or less of the width of the base, spatulate, with slightly emarginate symmetrical apex, the tip a little incurved, thin, and longitudinally inrolled, *i. e.*, from side to side convex externally, concave internally, subgenital plate similar to that of *attenuatus*.

"Color light yellowish green, without fuscous markings on sides of abdomen. Hind tibiae glaucous. Post-ocular fuscous stripe obsolete on metazone, interrupted on prozone by two narrow oblique yellowish green fasciae.

"Length of body: male, 17; hind femora: male, 11.5; antenna: male, 12; tegmina: male, 2×3 mm."

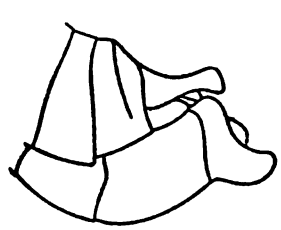
Georgia: Savannah, Aug. 14.

Lower Austral zone. A near relative of *attenuatus* and occurring in the same kind of habitat: tangled growth of grass, sedge, weeds, etc., on swampy ground.

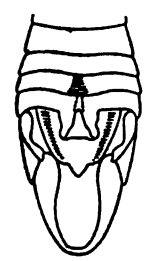
Melanoplus rotundipennis Scudd.

Florida: Live Oak, Aug. 10.

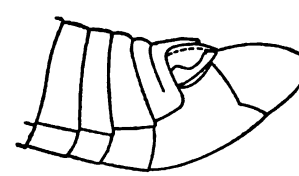
Gulf strip of Lower Austral zone. Quite numerous at one spot in the piney woods, varying much in color according to background, from mottled grayish on sand to dark red-brown among leaves and other plant débris.



11



13



12

FIG. 11.—*Melanoplus decoratus.* Lateral view of end of abdomen of male.
FIG. 12.—*Melanoplus strumosus.* Lateral view of end of abdomen of male.
FIG. 13.—*Melanoplus strumosus.* Dorsal view of end of abdomen of male.
(Magnified 6 diameters.)

Melanoplus decoratus Morse.

Melanoplus decoratus. Psyche, XI, 12 (1904).

"Related to *decorus* (Scudder, Rev. Mel., p. 257, pl. 17, fig. 5). Vertex rather strongly protuberant, especially in female. Pronotum with mid-carina strong on metazone, weak or indistinct on prozone.

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Tegmina asymmetrically obovate, the costal margin more convex. Supra-anal plate nearly as broad as long, the sides convex or sinuate, apex rounded or acute, the supernumerary longitudinal ridges feebly developed or indistinct. Furcula processes broad at base, rather strongly divergent, tapering, the sides more or less sinuate, once and a half or twice as long as the last dorsal segment. Cerci broader than in *decorus*, especially at tip, the apex transversely excised, the ventral apical angle produced, the dorsal well rounded, the extreme tip slightly recurved. Subgenital plate strongly constricted at base, (more than in *decorus*), the sides less ampliate basally, the apical tubercle much enlarged, produced, and curved upward, the ventral length of the plate almost or quite equal to its basal depth, the whole structure appearing more like a malformation than otherwise.

"Color dark reddish brown, yellow beneath, sides of pronotum below post-ocular stripe white, the stripe percurrent, suffusing pale metepisternal fascia, continued nearly or quite to end of abdomen, sometimes rather faintly in female, but more pronounced and constant than in the females of the other species here described. The body is stouter than in *decorus*, the hind femora shorter and stouter, and usually bifasciate.

"Length of body: Male, 15–18; female, 21.5–25; hind femora: male, 9.5–11; female, 10.7–12; antenna: male, 8.5–9.5; female, 8–9; tegmina: male, 2 × 3, 2.5 × 4; female, 2.8 × 4, 4 × 5 mm."

(See Fig. 11, p. 51.)

Virginia: Wytheville, Sept. 4, 5, 3000 to 3500 feet, near the High Rocks.
North Carolina: Murphy, July 25, 1800 feet; Topton, Aug. 21, 3000 to 4000 feet.
Georgia: Blue Ridge, July 25, 1700 feet.

(Austral ?) Transition zone. Dry mountain forests, among low shrubs.

Melanoplus strumosus Morse.

Melanoplus strumosus. Psyche, xi, 11 (1904).

"A small species with very small ovate tegmina, attingent in male, a little separated in female. Disk of pronotum twice (male) or once and a half (female) as long as wide, midcarina percurrent, lateral carinæ barely perceptible mesially. Prosternal spine prominent, flattened cylindric, slightly curved backward, apex transversely excised, the angles rounded. Mesosternal interspace quadrate in female, slightly longitudinal in male. Metasternal interspace longitudinal, twice as long as wide (female), narrower in male.

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Tegmina obovate, two-thirds as long as pronotum. Hind femora stout, very obliquely bifasciate with fuscous. Hind tibiae glaucous, flavescent at base and tip, with black-tipped spines.

"Male abdomen subclavate, the subgenital plate and preceding segment tumescent, broader than deep, and greatly elongated, the former elongate scoop-shaped, bluntly rounded at apex, its sides a little convex, especially at base. Supra-anal plate broader than long, somewhat trilobate at end by reason of deep, subapical lateral emarginations, the apex acutely pointed with straight sides, the basal three-fourths of each side smoothly convex, curving abruptly into the subapical emarginations. Its upper surface bears strongly raised edges and a prominent transverse ridge midway of its length, crossing two-thirds of its width. To this ridge extend, lying upon longitudinal ridges, the processes of the furcula; these are very broad at base, tapering equally to digitate, apically sinuate, tips which rest upon the ends of the transverse ridge, and enclose between them the shallow median sulcus, wide apically, narrow anteriorly. The base of the furcula and median portion of the segment bearing it are distinctly depressed; the median portion of the preceding segment is depressed to fit into this hollow, slightly elongated, widely and shallowly sulcate longitudinally, the sulcus transversely rugulose, with apical margin carinate opposite base of furcula. Cerci short and slender, about two-thirds as long as supra-anal plate, nearly three times as long as basal width, tapering evenly in basal half to one-fourth the basal width, distally bent gently upward and inward, the tip slightly expanded to about one-third the basal width, obliquely excised, the upper angle rounded, the ventral acute, the ventral margin convex or sinuous, the dorsal margin concave.

"General color deep reddish brown above, whitish or flavescent beneath. Post-ocular fuscous stripe indistinct in female, deep black in male, percurrent, extending to abdomen, even suffusing the metepisternal pale fascia.

"Length of body: male, 15; female, 17.5–22; hind femora: male, 10; female, 11.5–13; antenna: male, 6; female, 7; tegmina: male, 2×2.7; female, 2.5×3.5, 2.7×4 mm."

(See Figs. 12, 13, p. 51.)

South Carolina: Denmark, Aug. 15.
Florida: De Funiak Springs, Aug. 5.

Lower Austral zone. A very few specimens of this peculiar species were secured among shrubbery in open pine woods. (See Pl. 6, Fig. 1, type locality.)

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Melanoplus divergens Morse.

Melanoplus divergens. Psyche, XI, 8, (1904).

"A short-winged species of the same size and appearance as *islandicus* and its two relatives here described but belonging in a different series and easily distinguished by the sub-bifurcate cerci. Vertex blunt. Pronotum broad with flattened disk, subangulate at junction with lateral lobes, and moderately convex hinder margin, the mid-carina distinct on the metazone, absent from prozone. Prosternal spine short and variable, usually conical with acutely pointed tip but sometimes much broadened laterally with wide, bluntly rounded apex. Mesosternal interspace slightly transverse in the female, narrower than the lateral lobes, quadrate or a little transverse in the male. Metasternal interspace slightly transverse in the female, longitudinal in the male. Tegmina shorter than the pronotum, ovate, or ovate-lanceolate, with rounded apex, usually covering second abdominal segment but sometimes half this length, attingent in the male, separated in the female. The subgenital plate is truncate or even slightly emarginate at apex, the sides viewed from above nearly straight. The supra-anal plate is longer than wide, triangular, pointed at apex, the sides convex. Furcula moderately broad, about equalling the last segment in length. The cerci are quite distinctive, recalling those of *minor* in outline, being roughly boot-shaped, the base very broad, a little longer than wide, its sides parallel or convergent, the distal two-fifths bent abruptly upward at an angle of 35° or 40°, narrowed to about one-half the width of the base and tapering to a broad, evenly rounded blunt apex. At the union of the distal portion with the base the dorsal margin is deeply concave, the ventral margin strongly angulate, beyond the angle straight or a little concave, forming a sub-bifurcate organ as long as the supra-anal plate. The whole appendage is thick, strongly convex externally, especially on the tip, which is curved gently inward.

"General color dark reddish brown above, yellowish beneath, the hind tibiae red. Postocular fuscous stripes on head and prozone and pronounced fuscous markings on sides of abdomen and hind femora, The female is sometimes yellowish brown above.

"Length of body: male, 9–10; female, 11–20; hind femora: male, 8.5–9.5; female, 9.5–11; antenna: male, 6–6.5; female, 6–7; tegmina, male, 2–3; female, 2–4 mm."

(See Fig. 5, p. 46—drawing of male cercus.)

North Carolina: Balsam, July 24, Aug. 19, 5000 to 6000 feet.

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Transition zone. Sylvan in habit; found in Vaccinium thickets and other low shrubbery in deciduous forests and clearings.

Paroxya atlantica Scudd.

South Carolina: Denmark, Aug. 15.
Georgia: Savannah, Aug. 14; Tybee Island, Aug. 12, 13; Waycross, Aug. 11.
Florida: Carrabelle, Aug. 9; Fort Barrancas, Aug. 3; Warrington, Aug. 4.

Lower Austral zone. A locally common species found in the coast region in grassy swamps and marshes, either salt or fresh.

Paroxya floridiana Thom.

Virginia: Appomattox, Sept. 6; Norfolk, Sept. 8; Virginia Beach, Sept. 7.
North Carolina: Raleigh, July 9; Tunis, July 5.
Georgia: Savannah, Aug. 14; Stone Mountain, July 28; Tybee Island, Aug. 12, 13.
Florida: Carrabelle, Aug. 9; Marianna, Aug. 6; Warrington, Aug. 4.

Austral zones, coastwise to eastern Massachusetts. A widely distributed but local species occurring in grassy swamps and along the borders of streams and tidal inlets. (See Pl. 4, Fig. 2; Pl. 6, Fig. 2.)

Aptenopedes sphenarioides Scudd.

Georgia: Waycross, Aug. 11, (juv. 3, 5).
Florida: (Carrabelle, Aug. 9, juv. 4); (De Funiak Springs, Aug. 5, juv. 3); Live Oak, Aug. 10, (juv. 5); Tallahassee, Aug. 8, (juv. 4, 5).

Lower Austral zone. A not uncommon species locally in grassy spots among the piney woods, either in palmetto scrub, low bushes, or sedge and pipewort barrens. (See Pl. 5, Fig. 2.)

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FIG. 1—Habitat of *Trimerotropis saxatilis* on southern slope of Stone Mountain, Georgia.



FIG. 2—Habitat of *Trimerotropis saxatilis* on bare rock surface of Sand Mountain plateau, near Trenton, Georgia.

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FIG. 1—Habitat of *Trimerotropis citrina* and *Trimerotropis maritima* on sea-beach at Cape Henry, Virginia.



FIG. 2—Habitat of *Trimerotropis citrina* on sandy river-wash in Piedmont region, Morganton, North Carolina.

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FIG. 1—The Florida strand. Habitat of *Scirtetica picta*, *Trimerotropis citrina*, and *Psinidia fenestralis* on the Gulf coast, Carrabelle, Florida.



FIG. 2—The Florida strand. Habitat of *Orphulella olivacea*, *Paroxya atlantica*, etc., in Juncus fringes of inlets of the Gulf coast, near Fort Barrancas, Florida.

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FIG. 1—The Florida strand. Habitat of *Hesperotettix pratensis* at Fort Barrancas, Florida.



FIG. 2—Pine barrens. Habitat of *Gymnoscirtetes pusillus*, *Eotettix*, *Paxilla*, etc., among pipewort, Waycross, Georgia.

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FIG. 1—Type locality of *Melanoplus strumosus* amid shrubby growth of upland piney woods, DeFuniak Springs, Florida.



FIG. 2—Type locality of *Melanoplus symmetricus* in grassy swamp at Carrabelle, Florida. Habitat of *Paroxya floridiana* and *Schistocerca alutacea*.

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FIG. 1—Normal sylvan habitat of *Melanoplus amplectens*. Eupatorium thicket in deciduous woods on south slope of Roan Mountain, North Carolina.



FIG. 2—Extended habitat of *Melanoplus amplectens* in grass of clearing at Roan Valley, North Carolina.

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FIG. 1—Summit "balds" east of summit of Roan Mountain, North Carolina.



FIG. 2—Protective coloration of *Trimerotropis citrina*. Male and female locusts on sandy soil marked with raindrop impressions. Tarboro, North Carolina. (The rule to show scale.)

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